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ANNUAL REPORT

OF THE

BOARD OF REGENTS

OF THE

SMITHSONIAN INSTITUTI

SHOWING

THE OPERATIONS, EXPENDITURES, AND CONDITION
OF THE INSTITUTION

FOR THE

YEAR ENDING JUNE 30, 1892.

REPORT

OF THE

U. S. NATIONAL MUSEUM.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1893.

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HARVARD COLLEGE
SEP 18 1894
LIBRARY.

FIFTY-SECOND CONGRESS, SECOND SESSION.

Resolved by the Senate (the House of Representatives concurring), That there be printed of the reports of the Smithsonian Institution and of the National Museum for the year ending June 30, 1892, in two octavo volumes, 10,000 extra copies; of which 1,000 copies shall be for the use of the Senate, 2,000 copies for the use of the House of Representatives, 5,000 copies for the use of the Smithsonian Institution, and 2,000 copies for the use of the National Museum.

REPORT

OF THE

U. S. NATIONAL MUSEUM,

UNDER THE DIRECTION OF

THE SMITHSONIAN INSTITUTION,

FOR THE

YEAR ENDING JUNE 30, 1892.

REPORT OF THE U. S. NATIONAL MUSEUM FOR THE YEAR ENDING JUNE 30, 1892.

SUBJECTS.

I. Report of the Assistant Secretary of the Smithsonian Institution, in charge of the National Museum, upon the condition and progress of the Museum.
II. Reports of the Curators.
III. Papers illustrative of collections in the U. S. National Museum.
IV. Bibliography.
V. List of accessions.

U. S. NATIONAL MUSEUM
UNDER DIRECTION OF THE SMITHSONIAN INSTITUTION,
Washington, December 1, 1892.

SIR: I have the honor to submit herewith a report upon the present condition of the U. S. National Museum and upon the work accomplished in its various departments during the fiscal year ending June 30, 1892.

Very respectfully,

G. BROWN GOODE,
Assistant Secretary in charge of U. S. National Museum.

MR. S. P. LANGLEY,
Secretary, Smithsonian Institution.

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SECTION I.

REPORT

UPON THE

CONDITION AND PROGRESS OF THE U. S. NATIONAL MUSEUM DURING THE YEAR ENDING JUNE 30, 1892.

BY

G. BROWN GOODE,

ASSISTANT SECRETARY OF THE SMITHSONIAN INSTITUTION, IN CHARGE
OF U. S. NATIONAL MUSEUM.

REPORT

UPON

THE CONDITION AND PROGRESS OF THE U. S. NATIONAL MUSEUM DURING THE YEAR ENDING JUNE 30, 1892.

BY

G. BROWN GOODE,

Assistant Secretary, Smithsonian Institution, in charge of U. S. National Museum.

A.—GENERAL CONSIDERATIONS.

The report now presented relates to the operations of the National Museum during the fiscal year ending June 30, 1892.

The history of the origin and development of the National Museum has been discussed in previous reports, both in the introductory pages and in a paper published in the report for 1891, entitled "The Genesis of the National Museum."* It will therefore be sufficient for our present purpose to repeat a few of the most essential facts.

The Smithsonian Institution was established by act of Congress in 1846. One of the provisions of the act was that all objects of art and of foreign and curious research, and all objects of natural history, plants, and geological and mineralogical specimens belonging to the United States, should be placed in the custody of the Smithsonian Institution. As one of the results of this provision, the collections, both of ethnological and natural history objects, made by the numerous Government exploring expeditions, came into the possession of the Institution. These, with the "National Cabinet of Curiosities," which was exhibited in the Patent Office building, and which was transferred to the Smithsonian Institution in 1858, formed an important nucleus around which thousands of other collections have since gathered. The "National Cabinet of Curiosities" was a name given to the collections of the "National Institution," which was organized six years before the act creating the Smithsonian Institution had been passed.

The National Museum thus grew up under the care of the Smithsonian Institution, and the Secretary of the Institution was appointed by Congress "Keeper of the Collections."

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*P. 273.

The National Museum has been recognized as such by Congress for many years, but it was not until 1879 that an appropriation was made, providing money for the construction of a building especially intended for the display of the national collections. This action of Congress had been doubtless precipitated by the large increase made in the collections of the Government at the close of the Centennial Exhibition in 1876. The building was completed in 1881, during which year the collections were in part transferred to it from the Smithsonian building. In the following year a careful estimate of the extent of the collections, including the results of Government expeditions and gifts from private individuals, showed that the total number of specimens in the National Museum was 193,362. At the end of June, 1892, this total had increased to 3,223,941. Thus in one decade from what was practically the date of occupancy of the Museum building, the collections have increased sixteenfold. This result is certainly very gratifying. The Museum building is, however, very much overcrowded, and a new building is urgently needed. The attention of Congress has been frequently called to this matter, but nothing has yet been done. If the present unsatisfactory conditions are to exist much longer, such a rate of increase in the collections will, as has been already pointed out, become exceedingly embarrassing, and instead of endeavoring to interest people in contributing to the national collections, it will soon become necessary to discourage them from doing so. Indeed, this policy has already been adopted in certain instances, and the National Museum has lost control of several large and important collections. In the case of collections made by various branches of the Government, the Museum is obliged by law to receive them, having been appointed by Congress the custodian of such collections. The necessity of receiving these makes it the more incumbent to decline offers from private sources.

During the year the Museum has accomplished much in connection with the preparation of an exhibit for the World's Fair, to be opened in Chicago next May. In this the following departments of the Museum will be represented: Mammals, Birds, Reptiles, Fishes, Insects, Marine Invertebrates, Comparative Anatomy, Minerals, Physical Geology, Ethnology, American Prehistoric Pottery, Prehistoric Anthropology; as well as several sections of the Department of Arts and Industries, viz., Animal Products, Oriental Antiquities, Graphic Arts, and Musical Instruments.

PRINCIPAL SOURCES OF THE COLLECTIONS OF THE NATIONAL MUSEUM.

The collections of the National Museum are made up, to a very large extent, of the following materials:

(1) The natural history and anthropological collections, accumulated since 1850 by the efforts of the officers and correspondents of the Smithsonian Institution.

(2) Collections which have resulted from explorations carried on more or less directly under the auspices of the Smithsonian Institution.

(3) Collections which have been obtained through the courtesy of the Department of State and the coöperation of United States ministers and consuls.

(4) Collections which have been obtained by naval expeditions, such as the Wilkes exploring expedition, the Perry expedition to Japan, and other expeditions conducted by the Navy Department.

(5) Collections made by the scientific officers of Government surveys, such as the Pacific railroad survey, the Mexican boundary survey, and the surveys carried on by the Engineer Corps of the U. S. Army.

(6) Collections made by officers of the Signal Corps of the U. S. Army, stationed in remote regions.

(7) Collections obtained by the U. S. Geological Survey.

(8) Collections made by officers of the U. S. Fish Commission.

(9) Collections resulting from expeditions conducted by other departments of the United States Government.

(10) Collections resulting from explorations carried on by the Smithsonian Institution in connection with educational institutions or commercial establishments.

(11) Collections resulting from explorations conducted by private individuals.

(12) The collections made by the United States to illustrate the animal and mineral resources, the fisheries, and the ethnology of the native races of the country on the occasion of the International Exhibition at Philadelphia in 1876; the fishery collections displayed by the United States at the International Fisheries Exhibitions at Berlin in 1880 and at London in 1883, and the collections obtained from various local expositions—as, for instance, the New Orleans Cotton Centennial Exposition in 1884 and 1885, and the Cincinnati Exposition in 1887.

(13) The collections given by the governments of the several foreign nations, thirty in number, which participated in the Philadelphia exhibition in 1876.

(14) The industrial collections given by numerous manufacturing and commercial houses of Europe and America at the time of the Philadelphia exhibition and subsequently.

(15) The material received, in exchange for duplicate specimens, from museums in Europe and America, at the time of the Philadelphia exhibition and subsequently.

(16) Collections received as gifts, deposits, or in exchange, from individuals, numbering usually from 1,000 to 1,500 each year.

B.—SPECIAL TOPICS OF THE YEAR.

INCREASE IN THE COLLECTIONS.

During the year the collections have been increased by the addition of more than 228,000 specimens. These are, for the most part, contributions, and have been obtained without any special effort on the part of the Museum. The total number of specimens now in the collections is 3,223,941.

INCREASE IN THE MUSEUM LIBRARY.

The number of publications added to the Museum library during the year was 11,892, including 693 volumes of more than 100 pages, 1,642 pamphlets, and 8,486 parts of regular serials.

DECREASED EDITION OF THE REPORTS OF THE SMITHSONIAN INSTITUTION AND NATIONAL MUSEUM.

The edition of the Report of the Smithsonian Institution, including that of the National Museum, has been reduced by the Fifty-second Congress to 10,000 extra copies.

VISITORS.

The number of visitors to the Museum building during the year ending June 30, 1892, was 269,825, and during the same period 114,817 persons visited the Smithsonian building. The total number of visitors since 1881 to the Museum building is 2,668,200, and to the Smithsonian building, 1,196,498.

MUSEUM APPROPRIATIONS FOR 1892-'93.

Preservation of collections	$132,500
Furniture and fixtures	15,000
Printing	12,000
Heating and lighting	11,000
Postage	500
Total	171,000

This is $42,500 less than for the preceding year.

PROPOSED ADDITIONAL MUSEUM BUILDING.

On January 21, 1892, the bill providing for a new Museum building was introduced in the Senate and referred to the Committee on Public Buildings and Grounds. It was favorably reported by this committee February 26, and passed the Senate April 14. The bill was referred to the same committee in the House of Representatives, but was not reported. It has now passed the Senate three times, but has failed of action in the House.

REPRESENTATION OF THE UNITED STATES AT THE MADRID EXPOSITION.

In accordance with an act of Congress, approved May 13, 1892, the President appointed a commission to represent the United States at the Columbian Historical Exposition to be held in Madrid in 1892, in commemoration of the fourth centenary of the discovery of America. The commission consisted of Rear-Admiral S. B. Luce, U. S. Navy, commissioner-general; Dr. James C. Welling, president of the Columbian University, Washington, and Dr. G. Brown Goode, Assistant Secretary of the Smithsonian Institution, commissioners.

The act of Congress authorizing the participation of the United States in the Madrid Exposition reads as follows:

> For the expense of representation of the United States at the Columbian Historical Exposition to be held in Madrid in eighteen hundred and ninety-two in commemoration of the four-hundredth anniversary of the discovery of America, fifteen thousand dollars, or so much thereof as may be necessary, to be expended under the direction and in the discretion of the Secretary of State; and the President is hereby authorized to appoint a commissioner-general and two assistant commissioners, who may, in his discretion, be selected from the active or retired list of the Army or Navy, and shall serve without other compensation than that to which they are now entitled by law, to represent the United States at said exposition; that it shall be the duty of such commissioners to select from the archives of the United States, from the National Museum, and from the various Executive Departments of the Government such pictures, books, papers, documents, and other articles as may relate to the discovery and early settlement of America and the aboriginal inhabitants thereof; and they shall be authorized to secure the loan of similar articles from other museums and private collections, and arrange, classify, and install them as the exhibit of the United States at the said exposition; that the President is authorized to cause the detail of officers from the active or retired list of the Army or Navy to serve without compensation other than that to which they are now entitled by law, as assistants to said commissioners; and the said commissioners shall be authorized to employ such clerical and other assistance as may be necessary, subject to the approval of the Secretary of State.

NECROLOGY.

Prof. H. N. Moseley, of Oxford, England, a highly valued correspondent of and contributor to the National Museum, died on November 10, 1891.

Prof. Sereno Watson, curator of the herbarium of Harvard University, died March 9, 1892. Prof. Watson was recognized as one of the foremost botanists of the world, and was for many years a correspondent of the Museum.

Another valued correspondent, Gen. Mariano Jiménez, governor of the State of Michoacan, Mexico, and founder of the museums of Oaxaca and Michoacan, died February 28, 1892.

C.—THE CONDITION OF THE COLLECTIONS.

CENSUS OF THE COLLECTIONS.

Although no special effort has been made to increase the collections during the year, the accessions to the Museum since July, 1891, have exceeded that of the preceding fiscal year by 94,639 specimens, the total number of specimens received during the year covered by this report being 228,249, as is shown in the following table:

Departments.	Number of specimens.
Arts and industries:	
Materia medica	207
Domestic animals	6
Historical collections, coins, medals, etc	4,500
Musical instruments	94
Transportation and engineering	265
Modern pottery, porcelain, and bronzes	88
Graphic arts	200
Ethnology	2,241
American aboriginal pottery	1,817
Prehistoric anthropology	9,326
Mammals (skins and alcoholics)	1,086
Birds	5,610
Birds' eggs and nests	3,094
Reptiles and batrachians	1,004
Fishes	1,906
Vertebrate fossils	1,061
Mollusks (including cenozoic fossils)	6,225
Insects	16,500
Marine invertebrates	7,120
Comparative anatomy:	
Osteology	426
Anatomy	
Invertebrate fossils:	
Paleozoic	869
Mesozoic	3,099
Fossil plants	100,000
Recent plants	53,384
Minerals	4,121
Geology	4,000
	228,249

The yearly growth of the collections since 1882 is presented in the following table, the total number of specimens now in the Museum being 3,223,941:

Table showing annual increase in the collections since 1882.

Name of department.	1882.	1883.	1884.	1885-'86.[1]	1886-'87.	1887-'88.	1888-'89.	1889-'90.[2]	1890-'91.	1891-'92.
Arts and industries:										
Materia medica		4,000	4,442	4,850	5,516	5,762	5,942	[3] 5,915	6,083	6,290
Foods		1,244	1,580	822	877	877	911	1,111	1,111	1,111
Textiles			2,000	3,063	3,144	3,144	3,222	3,288	3,288	3,288
Fisheries			5,000	9,870	10,078	10,078	10,078	10,080	10,080	10,080
Animal products			1,000	2,792	2,822	2,822	2,948	2,949	2,994	2,994
Graphic arts								600	974	1,174
Transportation and engineering								1,250	1,472	[4] 1,737
Naval architecture			600				600	[5] 600	[5] 600	[5] 600
Historical relics				1,002	13,634	14,640	14,990	20,890	23,890	28,390
Coins, medals, paper money, etc				1,005						
Musical instruments				400	417	427	427	447	542	636
Modern pottery, porcelain, and bronzes				2,278	2,238	3,011	3,011	3,132	3,144	3,232
Paints and dyes				77	100	100	109	197	197	197
"The Catlin Gallery"				500	500	500	500	(6)		
Physical apparatus				250	251	251	251	263	273	273
Oils and gums				197	198	198	213	1,112	1,112	1,112
Chemical products				659	661	661	688			
Domestic animals								66	97	103
Ethnology			200,000	500,000	503,764	505,464	506,324	508,830	510,630	512,871
American aboriginal pottery			12,000	25,000	26,022	27,122	28,222	29,269	30,488	32,305
Oriental antiquities							850	3,485	3,487	3,487
Prehistoric anthropology	35,512	40,491	45,252	65,314	101,650	108,631	116,472	123,677	127,761	137,087
Mammals (skins and alcoholics)	4,660	4,920	5,694	7,451	7,811	8,058	8,275	8,836	9,301	10,387

[1] No census of the collection taken.

[2] The actual increase in the collections during the year is much greater than appears from a comparison of the totals for 1889 and for 1890. This is explained by the apparent absence of any increase in the departments of lithology and metallurgy, the total for 1890 in both of these departments combined showing a decrease of 46,314 specimens, owing to the rejection of worthless material.

[3] Although about 200 specimens have been received during the year, the total number of specimens in the collection is now less than that estimated for 1889, owing to the rejection of worthless material.

[4] The collection now contains between 3,000 and 4,000 specimens.

[5] No estimate of increase has been made since 1889.

[6] Included in the historical collection.

Name of department.	1882.	1883.	1884.	1885-'86.[1]	1886-'87.	1887-'88.	1888-'89.	1889-'90.[2]	1890-'91.	1891-'92.
Birds	44,354	47,246	50,350	55,945	54,987	56,484	57,974	60,219	[3] 62,601	68,416
Birds' eggs and nests			40,072	44,163	48,173	50,055	50,173	51,241	52,166	55,260
Reptiles and batrachians			23,495	25,344	27,542	27,664	28,405	29,050	29,935	30,939
Fishes	50,000	65,000	68,000	75,000	100,000	101,350	107,350	122,575	127,312	129,218
Vertebrate fossils								[4] 512	521	1,582
Mollusks	33,375		400,000	460,000	425,000	455,000	468,000	471,500	476,500	482,725
Insects	1,000		151,000	500,000	585,000	595,000	603,000	618,000	630,000	646,500
Marine invertebrates	11,781	14,825	200,000	350,000	450,000	515,000	515,300	520,000	526,750	533,870
Comparative anatomy:										
Osteology	3,535	3,640	4,214	10,210	11,022	11,558	11,753	12,326	12,981	[5] 12,555
Anatomy	70	103	3,000							
Palæozoic fossils		20,000	73,000	80,482	84,491	84,649	91,126	92,355	92,970	93,839
Mesozoic fossils			100,000	69,742	70,775	70,925	71,236	71,305	79,754	82,853
Cenozoic fossils		(Included with mollusks.)								
Fossil plants		4,624	7,291	7,429	8,462	10,000	10,178	10,507	10,685	110,685
Recent plants[6]				30,000	32,000	38,000	38,459	39,654	80,617	134,001
Minerals		14,550	16,610	18,401	18,601	21,896	27,690	37,101	44,236	48,357
Lithology and physical geology	9,075	12,500	18,000	20,647	21,500	22,500	27,000	[7] 32,762	[8] 64,162	35,787
Metallurgy and economic geology		30,000	40,000	48,000	49,000	51,412	52,076			
Living animals						220	[9] 491			
Total	193,362	263,143	1,472,600	2,420,944	2,666,335	2,803,459	2,864,244	2,895,104	3,028,714	3,223,941

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[1] For notes 1 and 2 see p. 9.

[3] The total number of specimens in the department of birds in 1890-'91 was 62,806, instead of 62,601.

[4] Only a small portion of the collection represented by this number was received during the year 1889-'90.

[5] The apparent decrease in this department for the year 1891-'92 was occasioned by the transfer of a large number of skeletons to the department of vertebrate fossils.

[6] Up to 1890 the numbers have reference only to specimens received through the museum, and do not include specimens received for the National Herbarium through the Department of Agriculture. The figures given for 1890-'91 include, for the first time, the number of specimens received both at the National Museum and at the Department of Agriculture for the National Herbarium.

[7] Collections combined in October, 1889, under the department of geology. The apparent decrease of more than 50 per cent of the estimated total for 1889 is accounted for (1) by the rejection of several thousands of specimens from the collection, and (2) by the fact that no estimate of the specimens in the reserve and duplicate series is included.

[8] This number is, in reality, far in excess of the actual number of specimens available for exhibition and study, several thousand specimens having been discarded.

[9] Transferred to the National Zoölogical Park.

NOTE.—The fact that the figures for two successive years relating to the same collection are unchanged, does not necessarily imply that there has been no increase in the collection, but that for some special reason it has not been possible to obtain the figures showing the increase.

CATALOGUE ENTRIES.

The number of catalogue entries made in the books of the several departments during the year amounts to 40,550. One entry may include one specimen, or a number of specimens, if from the same locality, or several individuals of the same species.

Departments.	Number of entries.
Materia medica	55
Historical collections	75
Musical instruments	59
Transportation and engineering	161
Modern pottery	111
Graphic arts	179
Ethnology	1,243
American aboriginal pottery	18,874
Prehistoric anthropology	1,268
Mammals	1,086
Birds	5,609
Birds' eggs and nests	840
Reptiles and batrachians	1,055
Fishes	553
Vertebrate fossils	1,124
Mollusks (including cenozoic fossils)	2,546
Insects	295
Marine invertebrates	1,318
Comparative anatomy:	
Osteology Anatomy	574
Paleozoic fossils	95
Mesozoic fossils	419
Recent plants	512
Minerals	1,454
Geology	1,045
	40,550

DEVELOPMENT AND ARRANGEMENT OF THE EXHIBITION SERIES.

The overcrowded condition of the Museum building has prevented any extensive changes in the arrangement of the exhibition halls. Although a large number of interesting objects has been received during the year in almost every department, it has not been possible to place them on exhibition. They have, therefore, for the most part been stored away until additional facilities for exhibition purposes shall have been obtained. This can only be brought about by the passage by Congress of an act authorizing the construction of an additional Museum building. In spite of the many disadvantages under which the work of the Museum has been carried on during the year, considerable progress has been made in connection with the rearrangement of the collections on exhibition and in preparing specimens for installation, when it has been possible to provide the necessary space.

The curator of the department of ethnology has continued to mount and label new specimens, which will be held in readiness for exhibition when practicable. A large number of specimens of aboriginal pottery, consisting mainly of fragments collected by the officers of the Bureau of Ethnology in the tide-water districts of Maryland and Virginia, have been installed. In the section of graphic arts several important gaps have been filled. Table-cases have been placed in the alcoves to accommodate new specimens, and considerable progress has been made in the substitution of printed for written labels. Several exhibits relating to the development of the railroad and telegraph have been added to the collections in the section of transportation and engineering. The collection of birds' eggs has been carefully rearranged and relabeled, and new insect-proof cases have been provided. Numerous illustrations have been added to the systematic series of insects, making it nearly complete. A large collection of vertebrate fossils, from regions in the west, secured by Prof. O. C. Marsh, in connection with his official work for the U. S. Geological Survey, has been placed upon exhibition. This collection is arranged in a wall-case especially constructed for it, extending the entire length of the east side of the exhibition hall. The collection of Cambrian and Ordovician fossils has been completed, labeled, and placed upon exhibition. A large collection of Mesozoic fossils has been received from the Geological Survey, and a part of it has been placed upon exhibition. The herbarium has been practically rearranged. New genus covers and genus labels have been substituted for the old ones. An entirely new arrangement of the exhibition series of fossil plants was begun during the year. Heretofore, the plants have been arranged with a view to illustrating the origin and development of plant life, but it has been found desirable to substitute for this a geological arrangement. A large and exceedingly valuable collection of fossil plants has been presented by Mr. R. D. Lacoe, of Pittston, Pa., and portions of it will be placed upon exhibition as opportunity offers. A considerable portion of the exhibition series in the department of minerals has been remounted on ebonized blocks, and the entire collection will soon be similarly provided for. Two large mahogany cases have been provided for the exhibition of the gems and semi-precious stones. This collection embraces 2,215 specimens. There have been transferred to the exhibition hall about 1,800 specimens belonging to the exhibition and study series, which had accumulated in the mineral laboratory. In the department of geology considerable time has been devoted to the installation, in the south-west court, of the economic series, which may now be said to be in an approximately satisfactory condition. The collection of ores, tin, nickel, manganese and antimony are systematized, and temporary labels have, in most cases, been prepared. The laying of new pavements in the south-west court and west-south range necessitated the moving of all the floor-cases, and, incidentally, the rearrangement of the specimens.

D.—THE MUSEUM STAFF.

THE SCIENTIFIC STAFF.

Very few important changes in the personnel of the scientific departments of the Museum have occurred during the year.

Dr. James M. Flint, U. S. Navy, who has been honorary curator of the section of materia medica during the greater part of the time since its organization, was recalled by the Secretary of the Navy in November, 1891. He was succeeded by Dr. John C. Boyd, U. S. Navy, who remained until April 6, 1892, when he was relieved by Dr. William S. Dixon, U. S. Navy, who now occupies that position.

There are at the present time thirty-two organized departments and sections in the Museum under the care of curators, including honorary and acting curators, and assistant curators.

LIST OF CURATORS, ASSISTANT CURATORS, AND AIDS.

Arts and Industries: Dr. G. Brown Goode, Honorary Curator.
- **Materia Medica**: Dr. William S. Dixon, U. S. Navy, Honorary Curator.
- **Animal Products**: Mr. R. Edward Earll, Acting Curator.
- **Naval Architecture**: Capt. J. W. Collins, U. S. Fish Commission, Honorary Curator.
- **Fisheries**: Capt. J. W. Collins, U. S. Fish Commission, Honorary Curator.
- **Foods**: Prof. W. O. Atwater, Department of Agriculture, Honorary Curator.
- **Historical Collections, Coins and Medals**: Mr. A. Howard Clark, Curator.
- **Transportation and Engineering**: Mr. J. E. Watkins, Curator.
- **Oriental Antiquities**: Prof. Paul Haupt, Johns Hopkins University, Honorary Curator; Dr. Cyrus Adler, Johns Hopkins University, Assistant Curator.
- **Graphic Arts**: Mr. S. R. Koehler, Boston Museum of Fine Arts, Curator.
- **Forestry**: Dr. B. E. Fernow, Department of Agriculture, Honorary Curator.
- **Physical Apparatus**: Mr. W. C. Winlock, Smithsonian Institution, Honorary Curator.

Ethnology: Prof. Otis T. Mason, Curator; Mr. Walter Hough, Assistant.
American Prehistoric Pottery: Mr. William H. Holmes, Bureau of Ethnology, Honorary Curator.
Prehistoric Anthropology: Dr. Thomas Wilson, Curator; Mr. E. P. Upham, Assistant.
Mammals: Mr. Frederick W. True, Curator.
Birds: Mr. Robert Ridgway, Curator.
Birds' Eggs: Capt. C. E. Bendire, U. S. Army, Honorary Curator.
Reptiles and Batrachians: Dr. Leonhard Stejneger, Curator.
Fishes: Dr. Tarleton H. Bean, U. S. Fish Commission, Honorary Curator; Mr. Barton A. Bean, Assistant.
Vertebrate Fossils: Prof. O. C. Marsh, Yale College, Honorary Curator; Mr. Frederic A. Lucas, Assistant Curator.
Mollusks: Mr. William H. Dall, U. S. Geological Survey, Honorary Curator; Dr. R. E. C. Stearns, Adjunct Curator.
Insects: Dr. C. V. Riley, Department of Agriculture, Honorary Curator; Mr. Martin L. Linell, Aid.
Marine Invertebrates: Mr. Richard Rathbun, U. S. Fish Commission, Honorary Curator; Mr. James E. Benedict, Assistant Curator.
Comparative Anatomy: Dr. Frank Baker, National Zoölogical Park, Honorary Curator; Mr. Frederic A. Lucas, Assistant Curator.

Invertebrate Fossils:
- **Paleozoic:** Mr. C. D. Walcott, U. S. Geological Survey, Honorary Curator.
- **Mesozoic:** Dr. C. A. White, U. S. Geological Survey, Honorary Curator.
- **Cenozoic:** Mr. William H. Dall, U. S. Geological Survey, Honorary Curator.

Fossil Plants: Mr. Lester F. Ward, U. S. Geological Survey, Honorary Curator; Mr. F. H. Knowlton, Assistant Curator.

Botany: Dr. George Vasey, Botanist of the Department of Agriculture, Honorary Curator.

Minerals: Prof. F. W. Clarke, Chief Chemist, U. S. Geological Survey, Honorary Curator; Mr. William S. Yeates, Assistant Curator.

Geology: Mr. George P. Merrill, Curator; Mr. W. H. Newhall, Aid.

THE ADMINISTRATIVE STAFF.

No important changes in the administrative departments have been made during the year.

In the office of the Assistant Secretary, who has been appointed representative of the Smithsonian Institution and the National Museum at the World's Columbian Exposition, Mr. R. E. Earll has assisted in the preparation of the exhibit for the World's Fair.

The Department of Supplies and Accounts remains under the charge of Mr. W. V. Cox. A statement of the work of this department will be found on page 56.

The Division of Correspondence and Reports is under the charge of Mr. R. I. Geare. For a statement of the work accomplished, see page 61.

Mr. S. C. Brown is in charge of registration and storage. A report of his work will be found on page 23.

Mr. A. Howard Clark has continued his work as editor of the Proceedings and Bulletin of the Museum. He also has charge of the preparation and printing of labels.

Mr. John Murdoch, who has filled the position of librarian of the Museum since 1887, resigned May 15, 1892. At the close of the fiscal year his successor had not been appointed. A report upon the operations of the Library during the year will be found on page 31.

The superintendent of the Museum, Mr. Henry Horan, with Mr. Charles A. Steuart as assistant superintendent, continues in charge of the mechanics and laborers.

E.—REVIEW OF WORK IN THE SCIENTIFIC DEPARTMENTS.

DIVISION OF ANTHROPOLOGY.

ETHNOLOGY.

The work in this department for the past year has been chiefly confined to the preparation of an exhibit for the World's Columbian Exposition. After consultation, it was decided to unite the work of the Bureau of Ethnology, under the direction of the Smithsonian Institution, with that of the Department of Ethnology in the National Museum.

Several valuable contributions to the collections were received during the year. From the Cocopa, Yaki, Yuma, Papago, and other tribes of Sonora, Mexico, and Lower California, Mr. Edward Palmer collected for the Museum objects illustrating the industries of these tribes. Valuable material was also received from Mr. R. W. Bartleman, United States legation, Carácas, Venezuela; Prof. Henry H. Giglioli, director of the Royal Zoölogical Museum, Florence, Italy; Hon. Rounsevelle Wildman, United States consul at Singapore, India; Prof. I. C. Russell, U. S. Geological Survey; Lieut. G. B. Harber, U. S. Navy, and Mr. J. Walter Fewkes, Cambridge, Mass. The number of specimens received during the year was 2,241, and the number of catalogue entries 1,243.

PREHISTORIC ANTHROPOLOGY.

The curator, Dr. Thomas Wilson, has continued his investigations of the evidences of the remote antiquity of man in America, and in this connection has made a special study of arrow-heads and spear-heads, or knives. He was called upon to prepare exhibits for the Madrid Exposition and also for the World's Columbian Exposition.

About 10,000 specimens were added to the collections of this department during the year. The principal collections were received from Edward Palmer; the Royal Zoölogical Museum, Florence, Italy; the National Museum of Anthropology and Ethnology, Florence, Italy; A. C. Carlisle, De Witt Webb, the Bureau of Ethnology, Edward Lovett, Henry Balfour, and others.

ORIENTAL ANTIQUITIES.

This section is devoted to biblical archæology, and to the archæology, history, languages, arts and religions of the people of western Asia and Egypt, and is under the immediate charge of Dr. Cyrus Adler, as assistant curator. During Dr. Adler's recent visit to the east, in the interests of the World's Columbian Exposition, he obtained several interesting objects. Two carefully made and well-preserved paper molds of a piece of sculpture and a cuneiform inscription from Persepolis, have been received through the Department of State, from the Hon. Truxton Beale, United States minister to Persia. The Telfair Academy of Arts and Sciences of Savannah, Ga., has deposited a portion of the collection of oriental books and manuscripts owned by the late William B. Hodgson.

GRAPHIC ARTS.

The most important additions of the year, as reported by Mr. S. R. Koehler, curator, are the illustrations of the half-tone relief screen-process, and of a variety of the photo-aquatint intaglio process. Interesting specimens illustrating the advances made in chromo-collographic process-work were given by Mr. E. Bierstadt, of New York, and by the

J. B. Lippincott Company, of Philadelphia. About 200 specimens were added during the year, the catalogue entries numbering 179.

FORESTRY.

Dr. B. E. Fernow, honorary curator, reports that the forestry collection has not received many additions during the year. The lack of space for exhibition purposes has restricted his efforts toward developing the collection, and the bulkiness of the material makes it undesirable to add to it in the storage-rooms. The curator has, during the year, prepared for publication a list, with notes, of all the species of trees found in the parks of Washington, D. C.

AMERICAN ABORIGINAL POTTERY.

The operations of this department, as reported by Mr. William H. Holmes, honorary curator, consisted in the installation of a number of specimens from the tide-water districts of Maryland and Virginia, and the Gila Valley, Arizona. Among the principal contributions were fragments of ancient Pueblo ware from Arizona, received from the U. S. Geological Survey, and earthen vessels from Guadalajara, Mexico, collected by Capt. John G. Bourke, U. S. Army. The estimated number of specimens received during the year was 1,817.

TRANSPORTATION AND ENGINEERING.

Satisfactory progress is reported by the curator, Mr. J. E. Watkins. The accessions during the year are both valuable and interesting. They include, among other things, an electrical locomotive, which made a speed of 120 miles an hour at Laurel, Md., in 1889. The value of the collection of telegraphic apparatus has been greatly enhanced through the coöperation of Mr. George C. Maynard, secretary of the American Association of Inventors and Manufacturers. The collection showing the development of the typewriting machine has also received several important additions. Messrs. Wyckoff, Seamans & Benedict have deposited a model of the Sholes & Glidden typewriter, invented in 1867, and the original machine made from this model. Mr. J. T. Richards, assistant chief engineer of the Pennsylvania Railroad, presented a model of the monument erected at Bordentown, N. J. in 1891, to commemorate the first movement by steam on a railroad in the State of New Jersey, which occurred on November 12, 1831. Miss Katherine Parsons, of Washington, deposited a sedan chair decorated with gold, owned and used by the royal family of France during the reign of Louis XIV. The number of specimens received during the year was 265, the catalogue entries numbering 161.

FOODS.

Prof. W. O. Atwater, the honorary curator, while in Europe during the past fiscal year, spent considerable time in collating data available for use in preparing labels, charts, diagrams, and plans for the food collection in the National Museum. With this object in view he conferred with a number of experts and investigators and visited museums in which food collections are to be found. His recent study of the subject has strengthened his belief in the practicability of developing the collection in the National Museum in such a manner as to make it of great popular interest, to say nothing of its educational and scientific value.

MATERIA MEDICA.

Dr. William S. Dixon, U. S. Navy, who assumed charge of this section in October, 1891, as honorary curator, states that the labeling of the collection has been completed. The estimated number of specimens received during the year was 207, the larger portion of which was from the Royal Gardens at Kew, England. The catalogue entries numbered 55

DIVISION OF ZOÖLOGY.

MAMMALS.

Mr. Frederick W. True, curator, states that the work in this department has been seriously arrested by the necessary preparations for the exhibit at the World's Columbian Exposition.

Many foreign and domestic mammals were obtained from various sources. Dr. W. L. Abbott sent a valuable collection of East African mammals, and Mr. William Astor Chanler presented two excellent mounted heads of giraffes from the same locality. Dr. Edgar A. Mearns, U. S. Army, of the Mexican Boundary Commission, has sent in some finely prepared specimens from the border. The President of the United States deposited an armadillo which had been sent to him by Mr. R. R. Skaggs, of Breckenridge, Tex. More than fifty mammals were received from the National Zoölogical Park. The estimated number of specimens received during the year was 1,086.

BIRDS.

This department, under the charge of Mr. Robert Ridgway, as curator, shows a gratifying growth during the past year. The work of transferring the specimens in the study collection to new trays and cabinets has been vigorously pushed. The preparation of an exhibit of birds for the World's Columbian Exposition occupied a large share of the curator's time. The present state of the collection is more satisfactory than during the preceding year, the arrangement of the specimens being better adapted for the convenience of visitors. The estimated number of specimens added was 5,610, involving 5,609 catalogue entries.

BIRDS' EGGS.

The honorary curator, Capt. Charles E. Bendire, U. S. Army, reports that the collections are in excellent shape, having been carefully overhauled and relabeled. The most important contribution during the year was made by Dr. William L. Ralph, of New York, consisting of 1,630 eggs and 100 nests, several of the species being new to the Museum collection. This is the most valuable gift which has been made to this collection for several years. In view of the large number and great value of the contributions made by Dr. Ralph to the collection of birds' eggs in the National Museum, it is understood that this collection will not be drawn upon for purposes of exchange or donation, and that it will form an integral part of the national collection of birds' eggs. A number of specimens, gathered in the Death Valley region of southern California, were received from the Department of Agriculture. There were received during the yea 3,094 specimens, involving 840 catalogue entries.

REPTILES AND BATRACHIANS.

The curator, Dr. Leonhard Stejneger, reports that satisfactory progress has been made during the year. The work of installing, identifying, and labeling the collections has been actively continued, and preparations were made for an exhibit at the World's Columbian Exposition. The most valuable and interesting collection of reptiles received by the Museum since 1890 was the material sent by Dr. C. Hart Merriam, through the U. S. Department of Agriculture. These specimens, over 900 in number, were collected by the Death Valley Expedition in 1891 from the desert regions of California, Nevada and Utah. In addition to the collections mentioned in the last report, there has been received a number of specimens from Mr. P. L. Jouy, obtained by him in southern Arizona. Facilities for studying the collections were afforded to Dr. O. P. Hay, of Irvington, Ind., and Dr. G. Baur, of Worcester, Mass. In addition to his other duties the curator has continued his work on the supplementary volume of the "Nomenclator Zoölogicus." There were 1,055 entries in the catalogue of the department during the year, embracing 1,004 specimens.

FISHES.

The work accomplished has, in general, been similar to that of the preceding year. The honorary curator, Dr. Tarleton H. Bean, has been occupied with his duties in connection with the U. S. Fish Commission, and the routine work has chiefly devolved upon Mr. Barton A. Bean, assistant curator. Fifty-five sets of duplicate fishes were prepared for distribution to educational establishments. Each set contained about 125 species, including both fresh and salt water forms. Valuable collections were received from the U. S. Fish Commission, Prof. B. W. Evermann, Mr. P. L. Jouy, and Mr. Charles W. Richmond. The estimated number of specimens added to the collection was 1,906, the catalogue entries being 553.

VERTEBRATE FOSSILS.

A large collection of vertebrate fossils, secured by the honorary curator, Prof. O. C. Marsh, during his official work for the U. S. Geological

Survey, was received at the National Museum in July, 1891, and was immediately placed upon exhibition. This is the first installment in the Museum of the official collections of Professor Marsh. The specimens have been well catalogued and arranged by the assistant curator, Mr. F. A. Lucas. Another valuable collection, sent from New Haven by the honorary curator in 1886, is still in storage, on account of lack of room in the exhibition hall. Professor Marsh is now preparing two memoirs, containing a full description of the more important specimens lately deposited in the Museum. During the year, 1,124 catalogue entries were made, and about 1,061 specimens were added to the collection.

MOLLUSKS (INCLUDING TERTIARY INVERTEBRATE FOSSILS).

Mr. William H. Dall, honorary curator, reports that a large amount of time has been devoted to sorting, naming, cataloguing, and storing the duplicate shells. The greater portion of them is now packed in small boxes in the storage room, each specimen bearing its catalogue-number. A card-catalogue makes it possible to refer at a moment's notice to any duplicates in the collection. It has also been found necessary to arrange and catalogue the drawings of shells. The report on the "Later Tertiary of the United States," though in type, will be issued a few days too late to appear in the Bibliography of this year. Considerable labor has been bestowed on the continuation of the report on the "Florida Tertiary Mollusks," for the Wagner Institute of Philadelphia. The most valuable contribution during the year was a collection of shells from St. Helena, donated by Capt. W. H. Turton, of the Royal Engineers, Chatham, England. Mr. Rounsevelle Wildman, United States consul at Singapore, sent a collection of shells representing the principal marine forms of that vicinity. The number of specimens added during the year was 6,225, the catalogue entries being 2,546.

INSECTS.

Prof. C. V. Riley, honorary curator, reports that a large amount of time has been devoted to the study collections in the laboratory, although important additions have been made to the systematic exhibition series. Among the more important accessions are: 400 specimens of Heteroptera, received from Prof. A. L. Montandon, Bucharest, Roumania; a collection of Californian insects, from Mr. D. W. Coquillet, of Los Angeles; material collected by Mr. A. Koebele during the Death Valley expedition, in 1891, from the Department of Agriculture; 1,900 specimens of Lepidoptera (native and exotic) from Mr. G. Beyer, of New York; and 57 specimens, embracing 27 species, mostly Coleoptera, from Mr. Charles Dury, of Cincinnati, Ohio. Mr. Dury has also expressed his willingness to contribute more material, and to aid in every way possible in increasing the value of the collection. In September, 1891, Prof.

John B. Smith, entomologist of the New Jersey Agricultural Experiment Station, was requested by the National Museum to compare the North American Noctuidæ in several of the museums of Europe, while visiting that country for purposes of study. In London he studied the British Museum collections, and succeeded in identifying most of the Walker types and the species described by Guenee. He also made critical comparisons between the collections of Grote, Zeller and Walker. At the museum in the Jardin des Plantes, Paris, he succeeded in finding many of the insects studied by Guenee and Boisduval, which form, at least in part, the basis of their work on the North American Lepidoptera. At Berlin he examined the collections of the Royal Museum, including material which has been used as the basis of papers on North American species. At Dresden he examined the Staudinger collections, and compared long series from the Siberian, Alaskan, Icelandic, and other Arctic faunal districts. In the course of these studies Professor Smith collected considerable information for publication in the Proceedings of the National Museum, and he also succeeded in obtaining from Mr. W. Schaus, jr., who has collected extensively in Mexico and South America, a promise to present to the Museum his collection, which is very large and contains many of the types described in the Biologia Centrali Americana. About 16,500 specimens were added to the collection during the year, the catalogue entries numbering 295.

MARINE INVERTEBRATES.

Mr. Richard Rathbun, honorary curator, states that considerable progress has been made during the year in the study of the collections of this department. The accessions of the year show a marked increase both in number and in extent and value. The U. S. Fish Commission has transferred the collections of the *Albatross* in the North Pacific Ocean, and important collections made by the *Fish Hawk* and the *Grampus* have also been received. Some additions have been made to the exhibition series; but little can be done in this direction until more space can be provided. Mr. J. E. Benedict, assistant curator, has conducted experimental work with a view to the manufacture of some plastic substance suitable for reproductions of soft substances. The preparation of an exhibit representing the families of American marine invertebrates for the World's Columbian Exposition has progressed. Mr. Benedict and Miss Rathbun have completed a monograph of the genus *Panopeus*, and the latter has prepared catalogues of the *Pericerida* and *Maiidæ*. These will be published in the Proceedings of the U. S. National Museum. The department has received the assistance of several specialists in the determination of recently acquired material. The number of catalogue entries during the year is 1,318. The number of specimens received is 7,120.

COMPARATIVE ANATOMY.

The work of the year has consisted largely in the preparation and arrangement of osteological material by the assistant curator, Mr. F. A. Lucas. The most important accession of the year was the skeleton of a young sperm whale, obtained through the courtesy of the Life-Saving Service from the station at Green Run Inlet. The U. S. Fish Commission contributed valuable material. The increasing care of the collections has prevented any special researches. The exhibition series is in good condition. During the year 574 specimens were added to the collection, and a large number were transferred to the department of vertebrate fossils.

INVERTEBRATE FOSSILS (PALEOZOIC).

Mr. C. D. Walcott, honorary curator, has necessarily devoted the greater portion of his time to work connected with the U. S. Geological Survey, with which he is associated. The principal accessions during the year were received from the Geological Survey. The collection of Cambrian and Ordovician fossils was placed upon exhibition.

In the latter part of 1891 the attention of the curator was called to an unworked collection of Lower Carboniferous crinoids and associated invertebrates from Crawfordsville, Ind., comprising specimens brought together by Prof. Frank Bradley, and presented by Prof. O. C. Marsh to the Yale University Museum, and others gathered by the Rev. D. A. Bassett upon his farm at Crawfordsville, and also the property of the Yale Museum. The National Museum possessed at that time but one or two small specimens from this formation, and plaster casts of several others. The curator urged the extreme desirability of securing a full representation from this classic locality of North American Lower Carboniferous fossils. After some correspondence with Prof. Marsh, with this end in view, Mr. Charles E. Beecher, of the Yale Museum, submitted a proposition, offering to give to the National Museum a large number of the Bassett and Bradley fossils, provided the Museum would be willing to work up the collection and supply the necessary tools. This proposition was accepted, and the task of working up the collection was begun at New Haven, the university kindly furnishing abundant laboratory room and every facility for properly carrying on the work. The material, as it was received at New Haven, weighed two tons, and contained between 3,000 and 4,000 specimens, many of them, however, being duplicates. In addition to the single crinoids and groups of crinoids upon slabs, the collection includes fossil brachiopods, corals, and other invertebrates. It is estimated that the value of the share which will come to the National Museum will exceed double the amount of money expended in working up the collection. The material is very showy and attractive, and will form a valuable addition to the exhibition series.

The number of specimens received during the year was about 869, involving 95 catalogue entries.

INVERTEBRATE FOSSILS (MESOZOIC).

Dr. C. A. White, honorary curator, reports gratifying progress during the year. The most important accession was received from the U. S. Geological Survey. This embraced a large number of specimens, including some of the most important paleontological material studied by members of the Survey. There were 419 catalogue entries during the year, representing about 3,099 specimens.

DIVISION OF BOTANY.

FOSSIL PLANTS.

Prof. Lester F. Ward, honorary curator, states that the work has been chiefly confined to the installation and care of specimens. There were added to the collection more extensive and valuable accessions than in any previous year. The most important was the collection of fossil plants, presented by Mr. R. D. Lacoe, of Pittston, Pa. This collection numbers 100,000 specimens and is of world-wide reputation. Prof. F. H. Knowlton continued during the year his study of the Laramie flora, and identified a large collection of plants from the Bozeman (Montana) coal fields. The "Flora of the Dakota Group," by the late Prof. Leo Lesquereux, was printed during the year.

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F.—REVIEW OF THE ADMINISTRATIVE WORK.

REGISTRATION AND DISTRIBUTION.

In the report of Mr. S. C. Brown, registrar, it is stated that the total number of packages of all kinds received during the year is 36,702—an

The number of specimens received during the year was about 869, involving 95 catalogue entries.

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Dr. C. A. White, honorary curator, reports gratifying progress during the year. The most important accession was received from the U. S. Geological Survey. This embraced a large number of specimens, including some of the most important paleontological material studied by members of the Survey. There were 419 catalogue entries during the year, representing about 3,099 specimens.

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In the report of Mr. S. C. Brown, registrar, it is stated that the total number of packages of all kinds received during the year is 36,702—an

increase of 3,016 over the previous year. The entries covering these receipts number 2,970, of which 980 consisted of specimens and 918 of supplies intended for the National Museum. The record of outgoing packages for the year embraces 1,408 entries, covering 2,342 packages of various kinds. The storage register shows that during the year 57 packages have been withdrawn from storage by officers of the Museum, and that 290 packages have been temporarily placed in storage. During the year 98 transportation bills have been subdivided and copied, and 184 letters written relating to the transmission of packages through custom-houses and to railroad and express companies. In addition, 546 notices of transmission have been sent out. The total number of accessions, *i. e.*, lots of specimens received for the National Museum, during the year was 1,357. In addition, there were received 527 packages of specimens sent for examination and report. The disposition of the accessions among the departments in the Museum is shown in one of the appendices to the accession list, which constitutes Section V of this report.

The distribution records show that during the year 172 packages, containing 16,616 specimens, were sent out. These sendings included specimens given, lent, sent in exchange, and returned to the owners.

The following statement indicates, by geographical arrangement, the recipients of the duplicate specimens distributed, and the character of the material:

Geographical statement of the distribution of specimens during the year ending June 30, 1892.

NORTH AMERICA.

CANADA.

Peter Redpath Museum, Montreal: Cast of trilobite showing appendages. Gift. (D.* 7059).

Museum of the Geological Survey of Canada, Ottawa: Cast of trilobite showing appendages. Gift. (D. 7058.)

University of Toronto, Toronto: Collection of echinoderms, etc.; duplicate collection of casts of stone implements (set 10). Gift. (D. 7142.) (D. 7274.)

UNITED STATES.

ARIZONA. Edgar L. Storment, Tempe: Mud-puppy (1 specimen); lobsters (2 specimens); horseshoe crabs (2 specimens); holothurians (2 specimens), in exchange. (D. 6987.) (D. 7280.)

CALIFORNIA. Leland Stanford jr. University, Menlo Park: Fishes (3 specimens); duplicate collection of marine invertebrates (series IV, set 188). Gift. (D. 7096.) (D. 7234.)

L. L. Frost, Susanville: Fragment of meteorite. Gift. (D. 7126.)

COLORADO. University of Colorado, Boulder: Duplicate collection of minerals (set 121); duplicate collection of alcoholic fishes (set 45). Gift. (D. 7308.)

CONNECTICUT. Bridgeport Scientific Society, Bridgeport: Duplicate collection of minerals (set 109); duplicate collection of alcoholic fishes (set 50). Gift. (D. 7029.) (D. 7212.)

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* "D." refers to the distribution record kept in the registrar's office.

G. R. Lumsden, Greenville: Gorgonians and sponges (2 packages). Gift. (D. 7179.)

H. S. Williams, Haddam: Ores (24 specimens), in exchange. (D. 7005.)

Hartford Theological Seminary, Hartford: Duplicate collection of minerals (set 111); duplicate collection of casts of stone implements (set 6). Gift. (D. 7071.) (D. 7230.)

Peabody Museum, New Haven: Panopeus (4 specimens), in exchange. (D. 7087.)

Yale College Museum, New Haven: Cast of trilobite showing appendages. Gift. (D. 7055.)

District of Columbia. Miss Nellie Baird, Washington: Collection of unassorted Foraminifera. Gift. (D. 7166.)

Miss Mary Clark, Washington: Specimen of Moki Indian basket tray, in exchange. (D. 6805.)

Columbian University, Washington: Plaster cast of the Rosetta Stone. Gift. (D. 6997.)

Commissioner of Patents, Washington: Crude petroleum (34 samples). Gift. (D. 7157.)

E. E. Howell, Washington: Specimens of minerals (2 boxes, 1 bottle and 1 package); minerals (6 specimens), in exchange. (D. 6831.) (D. 6865.) Miscellaneous ores (183 specimens); three slabs of onyx and 300 pounds of iron ore; rocks (39 specimens) for exchange. (D. 6875.) (D. 6898.)

J. W. Langdale, Washington: Specimen of Vanadinite, in exchange. (D. 7258.)

S. Ward Loper, National Museum: Specimen of onyx, in exchange. (D. 7252.)

National Deaf Mute College, Washington: Special collection of duplicate marine invertebrates. Gift. (D. 7109.)

Soldiers' Home, Washington: Duplicate collection of casts of stone implements (set 2). Gift. (D. 7164.)

Illinois. William A. Morris, Aledo: Unios (7 specimens), in exchange. (D. 6882.)

Arizona Oynx Company, Chicago: Seven slabs of oynx, in exchange. (D. 7226.)

Indiana. Indiana University, Bloomington: Rocks (51 specimens). Gift. (D. 7028.)

Hanover College, Hanover: Duplicate collection of alcoholic fishes (set 16). Gift. (D. 7223.)

Indiana State Normal School, Terre Haute: Duplicate collection of alcoholic fishes (set 10). Gift. (D. 7181.)

Indian Territory. A. T. Odeneal, Lehigh: Lodestone (1 specimen). Gift. (D. 6819.)

Iowa. Iowa State Normal School, Cedar Falls: Duplicate collection of marine invertebrates (series IV, set 185); duplicate collection of alcoholic fishes (set 54). Gift. (D. 7084.) (D. 7192.)

Museum of State Library, Des Moines: Indian pottery (136 specimens). Gift. (D. 7089.)

Jefferson County Library Association, Fairfield: Duplicate collection of casts of stone implements (set 1). Gift. (D. 7120.)

Parsons College, Fairfield: Duplicate collection of alcoholic fishes (set 53). Gift. (D. 7191.)

Herbert E. Brock, Mason City: Indian implements (57 specimens); arrow and spear heads (50 specimens), in exchange. (D. 6820.) (D. 7218.)

Cornell College, Mount Vernon: Duplicate collection of minerals (set 106); duplicate collection of alcoholic fishes (set 2). Gift. (D. 6977.)

Kansas Baker University, Baldwin: Duplicate collection of minerals (set 116). Gift. (D. 7193.)

College of Emporia, Emporia: Duplicate collection of alcoholic fishes (set 21). Gift. (D. 7216.)

Southwest Kansas College, Winfield: Duplicate collection of minerals (set 108). Gift. (D. 7014.)

KENTUCKY. L. C. Lane, Frankfort: Collection of shells, in exchange. (D. 7332.)

State University, Louisville: Duplicate collection of minerals (set 117). Gift. (D. 7204.)

Central University, Richmond: Duplicate collection of alcoholic fishes (set 43). Gift. (D. 7235.)

LOUISIANA. Louisiana State University, Baton Rouge: Duplicate collection of alcoholic fishes (set 49). Gift. (D. 7211.)

Tulane University, New Orleans: Duplicate collection of alcoholic fishes (set 6); duplicate collection of minerals (set 118); duplicate collection of casts of stone implements (set 5); special collection of marine invertebrates (6 boxes). Gift. (D. 7140.) (D. 7225.) (D. 7226.)

MAINE. Dr. A. C. Hamlin, Bangor: Miscellaneous minerals (60 specimens), in exchange. (D. 6979.)

Maine State College, Orono: Miscellaneous ores (111 specimens), in exchange. (D. 7265.)

T. F. Lamb, Portland: Miscellaneous minerals (29 specimens), in exchange. (D. 7041.)

F. H. Thompson, Portland: Specimens of infusorial earth. Gift. (D. 7242.)

Colby University, Waterville: Duplicate collection of alcoholic fishes (set 14). Gift. (D. 7207.)

MARYLAND. Dr. George H. Williams, Baltimore: Minerals (15 specimens), in exchange. (D. 7152.)

Rockhill College, Ellicott City: Collection of casts of stone implements (set 4). Gift. (D. 7213.)

MASSACHUSETTS. George H. Barton, Boston: Ores (1235 pounds), for exchange. (D. 6871.)

Prof. W. O. Crosby, Boston: Collection of Nevada nickel ores, in exchange. (D. 6908.)

Massachusetts Institute of Technology, Boston: Ores (598 specimens), in exchange. (D. 7092.)

N. L. Wilson, Boston: Minerals (28 specimens), in exchange. (D. 7285.)

Museum of Comparative Zoölogy, Cambridge: Cast of trilobite showing appendages; specimen of Tile fish and 7 species of Scopelids. Gift. (D. 7056.) (D. 7289.)

Peabody Museum, Cambridge: Collection of Navajo dyes and dye stuff. Gift. (D. 6789.)

Bigelow School, Marlboro: Specimens of wulfenite and azurite. Gift. (D. 7004.)

Wellesley College, Wellesley: Duplicate collection of alcoholic fishes (set 13). Gift. (D. 7189.)

Worcester Society of Antiquity, Worcester: Photographs of the log of the steamship *Savannah* and Trevithick's locomotive, in exchange. (D. 7012.)

MICHIGAN. University of Michigan, Ann Arbor: Collection of casts of stone implements (set 7). Gift. (D. 7249.)

Frederick Stearns, Detroit: Collection of Unionidæ; miscellaneous shells (71 specimens), in exchange. (D. 6810.) (D. 6893.)

MINNESOTA. Hamline University, Hamline: Duplicate collection of alcoholic fishes (set 25). Gift. (D. 7231.)

State Normal School, Mankato: Duplicate collection of marine invertebrates (series IV, set 184); duplicate collection of alcoholic fishes (set 4). Gift. (D. 7062.)

Minnesota Academy of Natural Sciences, Minneapolis: Duplicate collection of alcoholic fishes (set 26). Gift. (D. 7277.)

University of Minnesota, Minneapolis: Fossil plants (12 specimens), in exchange. (D. 7245.)

State Normal School, St. Cloud: Duplicate collection of alcoholic fishes (set 47). Gift. (D. 7262.)

Gustavus Adolphus College, St. Peter: Duplicate collection of minerals (set 107). Gift. (D. 7003.)

MISSOURI. Hooper Institute, Clarksburg: Duplicate collection of minerals (set 114). Gift. (D. 7143.)

Missouri State University, Columbia: Duplicate collection of minerals (set 113). Gift. (D. 7135.)

C. A. Brockett, Kansas City: Stone (1 specimen). Gift. (D. 7132.)

Missouri Valley College, Marshall: Duplicate collection of alcoholic fishes (set 52). Gift. (D. 7195.)

Julius Hurter, St. Louis: Reptiles (7 specimens). Gift. (D. 6986.)

MONTANA. College of Montana, Deer Lodge: Duplicate collection of alcoholic fishes (set 15). Gift. (D. 7208.)

Homer Squyer, Mingusville: Shells (18 specimens), in exchange. (D. 7313.)

James Allen, Willis: Beauxite and cryolite (3 specimens). Gift. (D. 6800.)

NEBRASKA. Bellevue College, Department of University of Omaha, Bellevue: Duplicate collection of casts of stone implements (set 9). Gift. (D. 7282.)

University of Nebraska, Lincoln: Duplicate collection of alcoholic fishes (set 8); duplicate collection of casts of stone implements (set 8). Gift. (D. 7159.) (D. 7266.)

NEW JERSEY. Biological School, Avon-by-the-Sea: Duplicate collection of marine invertebrates (series IV, set 180). Gift. (D. 6821.)

Albert Mann, jr., Newark: Samples of ocean bottom. Gift. (D. 7075.)

J. C. Smock, Trenton: Specimens of labels, blocks, bottles, and wires used in exhibition series of the National Museum. Gift. (D. 7113.)

NEW YORK. Wells College, Aurora: Duplicate collection of marine invertebrates (series IV, set 181); duplicate collection of minerals (set 101); duplicate collection of alcoholic fishes (set 1). Gift. (D. 6848.) (D. 6976.)

Williamsburg Scientific Society, Brooklyn: Duplicate collection of minerals (set 119). Gift. (D. 7260.)

Society of Natural Sciences, Buffalo: Echinoderms (10 specimens). Gift. (D. 7081.)

Hamilton College, Clinton: Duplicate collection of alcoholic fishes (set 17). Gift. (D. 7209.)

State Normal School, Cortland: Duplicate collection of alcoholic fishes (set 51); duplicate collection of casts of stone implements (set 3). Gift. (D. 7196.) (D. 7182.)

Fort Edward Collegiate Institute, Fort Edward: Duplicate collection of minerals (set 112). Gift. (D. 7121.)

Charles Babcock, Cornell University, Ithaca: Onyx and syenite (1 specimen of each). Gift. (D. 7088.)

Cornell University, Ithaca: Rocks (48 specimens); bones of Great Auk, in exchange. (D. 7186.) (D. 7247.)

American Museum of Natural History, New York City: Cast of trilobite showing appendages. Gift. (D. 7060.)

S. P. Avery, New York City: Specimen of lithograph by Menzel, in exchange. (D. 7202.)

G. Beyer, New York City: Dried insects (2 boxes); dried insects (253 specimens), in exchange. (D. 7137.) (D. 7119.)

College of the City of New York, New York City: Duplicate collection of alcoholic fishes (set 22). Gift. (D. 7217.)

Robert Demcker, New York City: Minerals (52 specimens), in exchange. (D. 7085.)

Rev. Henry Baker Tristram, Durham: Bird skins (60 specimens), in exchange. (D. 6797.)

British Museum, London: Cast of trilobite, showing appendages; 69 specimens of ethnologica, in exchange. (D. 7053.) (D. 7201.)

Mr. Cossman, London: Shell marl from Alabama (2 barrels), in exchange. (D. 7065.)

H. E. Dresser, London: Bird skins (4 specimens), in exchange. (D. 7302.)

Hugh Fulton, London: *Turricula Bairdii* (10 specimens), in exchange. (D. 6832.)

George F. Harris, London: Shell marl (1 barrel), in exchange. (D. 7175.)

Owens College Museum, Victoria University, Manchester: Cast of trilobite showing appendages. Gift. (D. 7047.)

Prof. Henry Balfour, University Museum, Oxford: Candle-fish (*Thalichthys pacificus*), (5 specimens). Gift. (D. 7072.)

R. N. Worth, Plymouth: Ores (152 specimens), for exchange. (D. 6867.)

FRANCE.

M. C. Marquis G. de Laporta, Bouches-du-Rhone, Aix-en-Provence: Fossil plants (24 specimens). Gift. (D. 6964.)

University of Lille, Lille: Cast of trilobite showing appendages. Gift. (D. 7052.)

Museum of Natural History, Paris: Snakes (12 specimens). Gift. (D. 6818.)

GERMANY.

Dr. A. Nehring, Berlin: Specimens of seeds of North American Nymphæceæ; seeds of Brasenia and Nuphæ, in exchange. (D. 7124.) (D. 7241.)

Museum of Natural History, Bucharest, Roumania: Cast of trilobite showing appendages. Gift. (D. 7050.)

Zoölogical, Archæological, and Ethnological Museum, Dresden: Four casts of Easter Island tablets, in exchange. (D. 7269.)

Prof. R. Wiedersheim, Freiburg: Siren lacertina (4 specimens). Gift. (D. 7098.)

Geological Museum of the University of Jena, Jena: Cast of trilobite showing appendages. Gift. (D. 7045.)

University of Munich, Munich: Cast of trilobite showing appendages. Gift. (D. 7048.)

ITALY.

Zoölogical Museum, Bologna: Prof. C. Emery, insects (5 specimens). Gift. (D. 7079.)

Royal Zoölogical Museum, Florence: Prof. Henry H. Giglioli, ethnological material (172 specimens) and archæological material (100 specimens), in exchange. (D. 6988.)

NORWAY.

Zoölogical Museum of the University of Christiania, Christiania: Skin of young sea-lion and model of skull; fishes (2 specimens), in exchange. (D. 6824.) (D. 7102.)

RUSSIA.

Geological Museum of the University of Moscow, Moscow: Cast of trilobite showing appendages. Gift. (D. 7016.)

Imperial Academy of Sciences, St. Petersburg: Cast of trilobite showing appendages; geological specimens (2 boxes), and publications, in exchange. (D. 7054.) (D. 7170.)

SWEDEN.

Geological Survey of Sweden, Stockholm: Cast of trilobite showing appendages. Gift. (D. 7044.)

The following table shows the number of specimens distributed from the various departments of the Museum during the year ending June 30, 1892:

Department.	Number of specimens.	Department.	Number of specimens.
Graphic arts	1	Mollusks	583
Ethnology	303	Insects	258
Historical collections	1	Marine invertebrates	5,855
American aboriginal pottery	236	Paleozoic fossils	17
Prehistoric anthropology	1,301	Fossil plants	36
Mammals	31	Recent plants	15,748
Birds	250	Minerals	1,753
Birds' eggs and nests	8	Geology	231
Reptiles and batrachians	276		
Fishes	5,132	Total	32,046
Vertebrate fossils	26		

LIBRARY.

Mr. N. P. Scudder, assistant librarian, has furnished the following statement in regard to the operations of the Museum library during the year:

The number of publications added to the library is 11,892 (693 volumes of more than 100 pages, 1,642 pamphlets, and 8,486 parts of regular serials). Of these, 297 volumes, 774 pamphlets, and 6,363 parts of serials have been retained for the use of the Museum from the accessions of the Smithsonian Institution, the remainder being obtained, as usual, by gift, exchange, and purchase.

During the year, 6,094 books were borrowed from the library, of which 1,832 had been returned at the close of the year. The books assigned to the sectional libraries are counted with those borrowed, hence the great excess of these over those returned. During the year, 243 orders for books were sent to the Library of Congress. There have been added 2,235 titles to the card-catalogue by authors, and 1,989 cards were added to the subject-catalogue, making a total of 3,827 cards in this catalogue.

SECTIONAL LIBRARIES.

The designations of the sectional libraries now organized, and the number of books assigned to each, are as follows:

Administration.—141 volumes, 74 parts, and 81 pamphlets.
Aëronautics.—3 volumes and 29 parts.
Astronomy.—63 volumes, 522 parts, and 19 pamphlets.
Birds.—589 volumes, 155 parts, and 56 pamphlets.
Editor.—656 volumes, 229 parts, and 46 pamphlets.
Ethnology.—379 volumes, 99 parts, and 29 pamphlets.
Fishes.—52 volumes, 19 parts, and 10 pamphlets.
Geology.—717 volumes, 169 parts, and 455 pamphlets.

Breseman, Henry, Wayne Wis.: Copper implement. 1554 (III).

Bringhurst, Dr. William, Philadelphia, Pa.: Insects; water containing egg-shaped insects. 1470, 1477 (X).

Brinkley, Thomas C., Cleveland, Ohio: Insect. 1303 (X).

British Museum, London, England, through Dr. D. Sharp: Collection of West Indian hemiptera and hymenoptera. 1316 (X).

Brock, A. B., Osceola, Mo.: Mineral. 1771 (XVI).

Brock, Herbert E., Mason City, Iowa: 11 specimens of crinoids. 1626 (25508) (XIII-A).

Brockway, W. J., Vallicita, Cal.: Substance found after a rain shower in roads, fields, etc. 1547 (XV).

Brooke, A. C., Lexington, Va.: Insect. 1443 (X).

Brown, Abram, Robertstown, Pa.: Ore. 1345 (XVII).

Brown, G. S., Vandalia, N. Y.: Insect. 1346 (X).

Brown, Phil. F., Blue Ridge Springs, Va.: Insect. 1750 (X).

Brown, W. E., Pine Bluff, Ark.: Insect. 1447 (X).

Brown, Prof. W. J., U. S. Grant University, Athens, Tenn., through G. P. Merrill: Pharyngeal of *Aplodinotus grunniens*. (Returned.) 1736 (VII).

Bryan, William A. C., Nephi City, Utah: Ore. 1389 (XVII).

Bryan, Rev. C. B., Lenoir, N. C.: Mushroom; caterpillar from Danville, Va. 1352, 1508 (XV, X).

Bryan, T. J., Fort Gibson, Ind. T.: Plaster cast of a piece of metal found at Bush Creek, Adams County, Ohio. 1706 (III).

Buell, A. D., Palm Springs, Fla.: Insect. 1323 (X).

Bullene, George W., Seattle, Wash.: Rock. 1301 (XVII).

Bullock, David J., Bar Harbor, Me.: 2 specimens of wasps. 1271 (X).

Burk, Frank, Nephi City, Utah: Mineral. 1422 (XVII).

Campbell, H. C., Lansingburg, N. Y.: Beetle. 1670 (X).

Campbell, J. J., Hot Springs, N. C.: Minerals. 1379 (XVI).

Campfield, C. H., Dulzura, Cal.: Ores. 1620, 1625 (XVII).

Canter, A. F., Jordan Valley, Oregon: Rock. 1391 (XVII).

Carder, E. E., South Sioux City, Nebr.: Insect. 1263 (X).

Carlisle, Dr. J. P., Cold Springs, Tex.: Cretaceous echinoid (?). (Returned.) 1603 (XIII-B).

Carter, I, C., Macon, Ga.: Vegetable substance. 1772 (XV).

Carter, Miss Sue, Cloverport, Ky.: Mineral. 1682 (XVI).

Case, Mrs. H. M., Emmetsburg, Iowa: Plant. 1315 (XV).

Chambers, G. W., Egger, Ark.: 2 specimens of ores. (Returned.) 1647 (XVII).

Chambers, J. C., Paint Rock, Tenn.: Ancient Hebrew manuscript, ancient Hebrew book, 2 phylacteries in cases with straps. (Returned.) 1723 (I).

Chapman, Gilman, Bethel, Me.: Insect. 1262 (X).

Chase, James H., Wenatchee, Wash.: Quartz; rock. 1340, 1419 (XVI, XVII).

Chatham, W. S., Roanoke, Va.: Mineral substance found in sinking a shaft for iron. 1685 (XVI).

Chesney, J. C., Northumberland, Pa.: Ore. 1361 (XVII).

Christy, W. H., New York City: Metallized fossil from Peru. 1405 (XII).

Church, F. L., Shushan, N. Y.: Alcoholic specimen of six-legged frog. 1337 (24770) (VI.)

Church, Mrs. J. L. Woodlake, Ky.: Insect. 1355 (X).

Clark, A. Howard, Gloucester, Mass.: Portion of shoulder-girdle of skate. (Returned.) 1413 (XII).

Clark, Alexander, Port Angeles, Wash.: Ore. (Returned.) 1461 (XVII).

Clarke, D. O., Perico, Fla.: Insect. 1588 (X).

Clouse, Henry, Phebe, Tenn.: Ore. 1668 (XVII).

Cole, James, Meadville, Pa: 2 specimens of quartz. 1695 (XVI).

Coleman, B. L., Poindexter's Store, Va.: Moth. 1282 (X).

Collins, Dr. William, Somerset, Pa.: Surveyor's compass made by Rittenhouse and Potts, and used on the Mason and Dixon line survey in 1763–1767. (Returned.) 1505 (I).

Cone, C. C., Lagrange, Ind.: Moth. 1249 (X).

Cook, E. F., Omaha, Nebr.: Butterfly. (1375 (X).

Cook, Frank, Houston, Idaho: Rock. (Returned.) 1272 (XVII).

Cook, R. E., Nottingham, Ala.: Clay. 1637 (XVII).

Cooper, L. F., Crescent City, Cal.: Rock. 1657 (XVII).

Cooper, Samuel. (See under George Weston.)

Copeland, J. B., Harrisburg, Pa.: 2 specimens of stones. 1341 (XVII).

Cornick, Miss L. A. B., Genito, Va.: Minerals. (Returned.) 1287 (XVI).

Coyne, P. J., Gratersville, Ariz.: (Pottery (?) 1770 (III).

Craig, J. W., Mushet, Va.: Micaceous hematite. 1476 (XVII).

Crevecœur, F. F., Onaga, Kans.: 25 species of miscellaneous insects. 1502 (25028) (X).

Crites, Stanley M., Pipestone, Mich.: Rock. (Returned.) 1458 (XVII).

Crockett, J. T., Chambersburg, Ind.: Insect. 1445 (X).

Crook, Robert L., Eastonville, Colo.: Insect. 1493 (X).

Crosby, Prof. W. O., Boston, Mass.: Eruptive rocks. 1408 (XVII).

Cunningham, Burton L., Fort Klamath, Oregon: Butterflies. 1382 (X).

Curry, Mrs. Hattie G., Sioux City, Iowa: Moth. 1264 (X).

Dahl, F. O., Libby, Mont.: Stone implement. 1546 (25432) (III).

Daniel, Dr. Z. T., Blackfeet Agency, Piegan, Mont.: Stone, supposed to be a petrified imprint of a moccasin foot in soft sand, found by a Blackfeet Indian in Two Medicinal Creek. 1745 (25834) (III).

Daniels, William H., Fairhaven, Wash.: Insect. 1357 (X).

Darling, Elisha, Ridgway, Colo.: Mineral. 1687 (XVI).

Davis, B. S., Charlotte, N. C.: Plant. 1733 (XV).

Dell, Edward H., Scottsville, Mo., through Hon. Samuel W. Peel, M. C.: Madstone. (Returned.) 1585 (II–A).

Demcker, Robert, New York City: Minerals. 1703 (25758) (XVI).

De Meules, A. J., Organ, N. Mex.: Rocks. 1491 (XVII).

Dennett, W. S., Saco, Me.: Insects. 1494 (X).

Detrick, W. L., Julian, Cal.: 3 specimens of ores. (Returned.) 1616 (XVII).

Devereux, A., Decatur, Tex.: Fossil; stone. 1320, 1559 (VIII, XVII).

Dietz, Ottomar, New York City: 237 species of Coleoptera. (Returned.) 1623 (X).

Diggins, H. W., Springfield, Mo.: Ore. 1747 (XVII).

Diggles, Mrs. J. A., Etna, Cal.: Insect. 1313 (X).

Dodge, Mrs. Charles, jr., San Carlos, Ariz.: Large basket made by Chilchuana, an Apache Indian chief. 1523 (25088) (II–A).

Downman, R. H., Warrenton, Va.: Insect. 1417 (X).

Drake, Harry, Hatton, Ill.: Insect. 1366 (X).

Dugès, Prof. A., Guanajuato, Mex.: Insects; coral, parasitic worms. 1536, 1716 (25780), 1385, 1409 (X, XI).

Dunlap, R. S., Greenfield, Ohio: Carved bone. 1632 (III).

Du Pré, Prof. D. A., Wofford College, Spartanburg, S. C.: Mineral. 1490 (XVI).

Duscoll, M., Billings, Mont.: 2 butterflies. 1762 (X).

Eaton, Lucy C., Truro, Nova Scotia: Insects. 1690 (X).

Ebaugh, Jeremiah, Carrollton, Md.; Ore. 1640. (Returned.) 1666 (XVII).

Eckart, Edward, Waupun, Wis.: Butterfly. 1336 (X).

Eells, A. F., Boston, Mass.: Granite from Buck's Harbor, Maine. 1571 (XVII).

Egglestou, Mrs. L. T., Forest Depot, Va.: Leaf of plant. 1307 (XV).

Elker, R. F., Kenterville, Idaho: Ore. 1431 (XVII).

Ellis, F. G., Hogan, Mont.: Skull of mammal. 1663 (IV).

Ellithorpe, O. A., Gainesville, Tex.: Concretion. (Returned.) 1548 (XIII–B).

Emerson Brothers, Santa Ana, Cal.: Insect. 1719 (X).
Emmert, John W., Bristol, Tenn.: Chipped implements and a human skull. 1697 (III).
Ensign, George A., Defiance, Ohio: Insect. 1309 (X).
Evans, Hon. H. Clay, Chattanooga, Tenn.: Rock. 1572 (XVI).
Evans. William A., Jacksonville, Fla.: Insect. 1518 (X).
Faucher, C. H., Flagstaff, Ariz.: Phosphate rocks. 1592 (XVII).
Faulk, Charles, East Liverpool, Ohio: Ore. (Returned.) 1560 (XVII).
Ferguson, J. M., Bald Creek, N. C.: Mineral. 1501 (XVI).
Ferris, C. L., West Auburn, Pa.: Insect. 1279 (X).
Field, E. R., Helper, Utah: Fossil fish. 1744 (VIII).
Field, J. A., New Castle, Pa.: Plant. 1294 (XV).
Finney, Mrs. A. P., Washington, D. C.: Ore. (Returned.) 1462 (XVII).
Finnigan, Thomas, Dunlap, Ariz.: 3 specimens of rock. 1702 (XVII).
Fitch, M. L., Logansport, Ind.: Insect. 1701 (X).
Fitzgerald, J. C., Greenville, S. C.: Alcoholic specimen of jointed or glass snake. 1581 (25484) (VI).
Fitzjohn, A. W., Toledo, Ohio: Insect. 1326 (X).
Flack, J. O., Atoka, Ind. T.: 2 specimens of rock. (Returned.) 1463 (XVII).
Flagg, H. W., Martinsburg, W. Va.: Rock. (Returned.) 1662 (XVII).
Fletcher, S., Phebe, Tenn.: 7 specimens of rocks. (Returned.) 1691 (XVII).
Ford, R. T., Naillon, Tenn.: 2 small specimens of rock. 1612 (XVII).
Forrer, R., Strasburg, Germany: 43 specimens of antique Roman and Byzantine textile fabrics, and 10 tablets of wood with Greek, Egyptian, and Coptic inscriptions. (Returned.) 1594 (III).
Forrester, Robert, Scofield, Utah: Seeds; fossils; fossil shells; fossils; eruptive rock; 1653 (returned); 1656 (returned); 1675 (returned); 1678, 1694 (returned) (one specimen retained, 26000). (XIII-B, XV, XVII).
Fox, J. J., Horti, Fla.: Insects. 1370, 1464 (X).
Foy, Alfred D., Lookout Mountain, Tenn.: Plants. 1725 (XV).
Frazee, C. T., Villa Grove, Colo.: Small portion of the skeleton of a mammal. 1253 (IV).
Frye, Levi, Rinkerton, Va.: Ore, mineral. 1396, 1550 (XVII, XVI).
Gallagher, E. J., New York City: Mineral. 1543 (XVI).
Galvin, C. D., New York City: Sample of supposed phosphate from North Carolina. (Returned.) 1324 (XVII).
Garner, R. L., Roanoke, Va.: 4 teeth and 2 mammal horns (?) from the phosphate beds, Ashley River, South Carolina; 2 specimens of minerals. 1364, 1520 (VIII, XVI).
(See under J. Williams.)
Garwood, H. C., Jersey City Heights, N. J.: Insect. 1399 (X).
Gaskill, S. I., Salesville, Mont.: Ore. 1586 (XVII).
Gay, Miss Agatha, Staunton, Va.: Insects. 1773 (X).
Gibbs, W. B., Jackson, W. Va.: Rocks. (Returned.) 1380 (XVII).
Gieger, Martha A., Silver, Wash.: Ores. 1343 (XVII).
Gilbert, Mrs. L. R., Plainfield, N. J.: 44 species of Lepidoptera; 37 species of Lepidoptera from the United States and Ireland. 1484 (returned), 1535 (X).
Gilmore, C. W., Pipestone, Minn.: Worm. 1407 (X).
Gilmore, Mrs. J. W., North Fork, Cal.: Butterfly. 1331 (X).
Glenn, Harvey L., Livingston, Mont.: Mineral. 1674 (XVI).
Goldsmith, J., Carlisle, N. Mex.: Ore. (Returned.) 1251 (XVII).
Graham, Miss Rebecca, Davenport College, Lenoir, N. C.: Wasp. 1439 (X).
Gray, Harry and Ethel, Dell, Oregon: Insect. 1356 (X).
Griffin, Miss Anna H., Columbus, Ga.: Insect. 1398 (X).

Gudie, Robert, Nashville, S. Dak.: Sample of sand, small piece of rock out of which it was taken, and 24 small pebbles. 1609 (XVII).

Hagner, Gen. P. N., U. S. Army, Washington, D. C.: Ores. 1642 (XVII).

Hale, Dr. E. M., Chicago, Ill.: Snake. 1654 (25595) (VI).

Hall, Dr. C. H., Madison, Wis.: 2 lead models of turtle. (Returned.) 1394 (III).

Halley, J. T., Middlesboro, Ky.: Fossil plants. 1760 (XIV).

Ham, Mrs. R. C., Albany, N. Y.: Insect. 1344 (X).

Hammers, J. E., Luray, Va.: Butterfly, insect. 1322, 1764 (X).

Hanske, E. A., Bellevue, Iowa: Petrification. 1498 (XVII).

Harris, D. M., Homer, La.: Moth. 1260 (X).

Harris, Mary V., Cherry Creek, Miss.: Sample of earth. (Returned.) 1371 (XVII).

Harris, T. S., New York City: Sample of clay; brown sandstone. 1655, 1669. (Returned.) (XVII.)

Hart, Mrs. J. M., Blackstone, Va.: Insect. 1330 (X).

Hasbrouck, H. J., Idaho Falls, Idaho: Ore. 1752 (XVII).

Haskell, L., Fort Meade, Fla.: Specimen of supposed phosphate. 1671 (XVII).

Hassett, E., Atoka, Ind. T.; Two specimens of rocks. 1433 (XVII).

Hassett, E. B., St. Paul, Ark.: Ore. 1758 (XVII).

Hatch, Prof. John W., Agricultural Institute, Hampton, Va.: Insect. 1511 (X).

Hauschild, Henry, Sioux City, Iowa: Butterfly. (Returned.) 1280 (X).

Henry, Miss Mattie C., Lexington, Mich.: Butterfly. 1729 (X).

Heron, D. S., Globe, Ariz.: Ore. (Returned.) 1553 (XVII).

Herring, Mrs. E. B., Plainfield, N. J., through F. O. Herring: 25 species of Lepidoptera. (Returned.) 1500 (X).

Herring, F. O. (See under Mrs. E. B. Herring.)

Hester, L. G., Marble Falls, Tex.: Insect. 1349 (X).

Heymann, S., Lafayetteville, Tenn.: Three specimens of supposed gold. (Returned.) 1576 (XVII).

Hill, E. E. Rockland, Me.: Living specimens of beetles. 1455 (X).

Hill, T. Scott, Augusta, Me.: Rock. 1569 (XVII).

Hillyer, Miss Daisy, Corsicana, Tex.: Bone. 1672 (XII).

Hoare and Fett, Findlay, Ohio: Radish shaped like a man's hand. 1286 (XV).

Hobson, W. P., Pueblo, Colo.: Stone of peculiar formation. (Returned.) 1541 (XVII).

Hodges, Miss Corine L., Georgetown, Tex.: Butterfly. 1374 (X).

Hollingsworth, Miss Sarah, Dogwood, Mo.: Minerals, stone, ore. 1358, 1472, 1570 (XVI, XVII).

Holmes, A. I., Roscoe, Mo.: Skull. 1555. (VIII).

Holmes, N. D., Toledo, Ark.: Rock. (Returned.) 1435 (XVII).

Holmes, W. H. (See under C. G. Brashear.)

Hooper, J. J., Selma, Ala.: Insect. 1367 (X).

Hopkins, H., La Fayette, Oregon: Clay. 1710 (XVII).

Horton, O. E. and M. C., Pendleton, S. C.: Two insects. 1334 (X).

Houck, R. H., Springfield, Ohio: Fossil coral. 1362 (XIII-A).

Hourston, Joseph, Cumberland House, Canada: Mineral and a small piece of the same material melted. 1688 (XVI).

House, Miss Lily, State Mills, Virginia: Moth. 1378 (X).

Hovey, George U. S., White Church, Kans.: Stone. 1700 (XVII).

Howard, Ezra E., Edgar, Nebr.: Skin and skull of mountain goat from British Columbia. (Returned.) 1350 (IV).

Huddleston, John R., Kanawha Falls, W. Va.: Double-headed snake. 1384 (24823) (VI).

Hummel, James, Gloversville, N. Y.: 2 rocks. 1679 (XVII).

Hungate, J. H., La Harpe, Ill.: 2 inscribed stones and 4 fragments of arrowheads found by Weyman Huston. (Returned.) 1504 (III).

Hunt Bros., Sturgis, Miss.: Rocks. (Returned.) 1601 (XVII).

Hunt, George H., Kingston, Ill.: Spear-head. 1497 (III).

Hunt, J. R., jr., Sturgis, Miss.: Ore. (Returned.) 1641 (XVII).

Hunt, W. T., Sturgis, Miss.: Mineral. 1591 (XVI).

Hurd, Charles V., Harrisonburg, Va.: Insect. 1348 (X).

Huston, W. (See under J. H. Hungate.)

Hyatt, C. J., Iuka, Miss.: Geological material from the mountains of Alabama. 1720 (XVII).

Ijima, I. (See under Science College, Imperial University, Tokio.)

Intram, Robert, Chenowith, Wash.: Insects. 1753 (X).

James, H. A., Quartz, Okla.: Minerals, rock. 1575, 1652 (XVI, XVII).

Jaske, Brother Herman, Normal School, Brothers of Mary, Dayton, Ohio: Fossils from Besançon, France; specimens of marble. (Returned.) 1368 (XIII-A, XVII).

Johnson and James, Asheville, N. C.: 14 specimens of minerals. 1544 (XVI).

Johnson, W. E., Galena, Kans.: Insect. 1373 (X).

Johnston, F. J., New Carlisle, Ohio: Fragments of skull, bones, and 3 pieces of flint (?). 1562 (25633) (III).

Jones, E. Walley & Sons, Seattle, Wash.: 3 specimens of minerals. 1451 (XVI).

Kayser, William, Wapakoneta, Ohio: Insects. 1387, 1454 (X).

Keenan, Michael, Springer, N. Mex.: Stone. 1265 (XVII).

Kelly, C. M., Lewistown, Mont.: Insect. 1420 (X).

Kenney, George, Elk, N. C.: Ore. (Returned.) 1604 (XVII).

Kepler, Rev. William, Crestline, Ohio: 2 specimens of fossil cladodus. (Returned.) 1412 (XII).

Kincaid, Trevor, Olympia, Wash.: Series of Coleoptera. 1459 (X).

King, F. G., Rochester, N. Y.: Clay. 1297 (XVII).

Kirkbride, J. J., Richwood, N. J.: Stone axe. (Returned.) 1319 (III).

Kirksey, John R., Brindleton, N. C.: 230 Indian beads, grooved stone axe, 5 arrow-points taken from an Indian grave in North Carolina. (Returned.) 1755 (III).

Kitchen, E. C., Brownwood, Tex.: Ore. 1696 (XVII).

Knowles, F. E., Spencer, Iowa: Iowa grasses. 1519. (Returned.) 1298 (XV).

Kunz, George F., New York City: 12 reproductions of ancient gems. 1524 (XVI).

Lander, W. Tertsh, Williamston, S. C.: Fern. 1611 (XV).

Lane, L. C., Frankfort, Ky.: Fossil shells. 1621 (25523) (XIII-A).

Larsen, L, Alpha, Wash.: Mineral. 1430 (XVI).

Lartigue, Dr. G. B., Blackville, S. C.: Plant. 1610 (XV).

Laws, Franklin, Windom, N. C.: Minerals. 1392 (XVI).

Lea, J. S., Roswell, N. Mex.: Rock. 1595 (XVII).

Lee, A. E., Alpona, Wash.: Rocks. 1765 (XVII).

Legare, Miss Clara, Charleston, S. C.: Twelve buttons, taken from the uniform of Thomas Jones, who served in the Revolutionary war. (Returned.) 1226 (I).

Lewis, B., Thurber, Utah. Rock. 1580 (XVII).

Lewis, William H., North Fork, Pa.: Mineral. 1534 (XVI).

Lighton, William R., Omaha, Nebr.: Fossils. 1658 (XIII-A).

Ligon, Joseph, Massie's Mill, Va.: Mineral. 1488 (XVI).

Lindsey, H. A., Asheville, N. C.: Mineral. 1513 (XVI).

Linthicum, Cassady, Hyattstown, Md.: Ores. 1376. (Returned.) 1734.

Lipscomb, R. S., Beans Creek, Tenn.: Spider. 1327 (X).

Livingston, Alexander, Wichita, Kans.: Four specimens, supposed to be Chinese or Japanese coins. 1530 (I).

Long, John, Sand Point Station, Idaho: Ore. 1432 (XVII).

Long, Le Roy, Lowesville, N. C.: Insect. 1295 (X).

Louden, J. Albert, Frenchville, W. Va.: Spanish bill ($30). 1531 (I).

Lowe, Camille, Knights Ferry, Cal.: Insects. 1406, 1480 (X).

Lowe, James H., Knights Ferry, Cal.: Butterfly. 1318 (X).

Lowenstein, William, jr., Keokuk, Iowa: Four specimens of beetles. 1274 (X).

Luce, George S., Galesville, Wis.: Clay found in a phosphate bed in Florida. 1739 (XVII).

Luke, J. C., Irwinville, Ga.: Insect. 1273 (X).

Luse, J. E., Cisco, Tex.: Ore. 1452 (XVII).

Lyle, S. W., Madison, Ind.: Moth. 1314 (X).

Lyons, Rev. J. A., Gonzales, Tex.: Plant. 1732 (XV).

McAlerney, C. W., Plymouth, Pa.: 4 specimens of rock. (Returned.) 1578 (XVII).

McCann, A. F., Jeffersonville, Ind.: Insect. 1400 (X).

McConnel, William, Muncie, Ind.: Insect. 1363 (X).

McDonald, Col. Marshall, U. S. Commissioner of Fisheries, through Mr. Richard Rathbun: 2 specimens of minerals. 1302 (XVI).

McGloskey, Joseph J., Asheville, N. C.: Butterfly. 1335 (X).

McGuire, F. M., Chico, Mont.: Ore. 1456 (XVII).

McIntyre, James M. R., River Dennis, Nova Scotia: Insect. 1495 (X).

McKendree, Mrs. M. L., Fort Klamath, Oregon: Collection of butterflies. 1769 (X).

McLucas, J. D., Marion, S. C.: Scales of Gar. 1275 (VII).

MacRae, Hugh, Wilmington, N. C.: Small seed. 1737 (XV.)

McVay, William, Prineville, Oregon: Ore. 1598 (XVII).

Main, H. H., Lincoln, Nebr.: Insects. 1285 (X).

Malone, George W., Hornbeak Post Office, Tenn.: Ore. (Returned.) 1532 (XVII).

Marsh, Charles H., Dulzura, Cal.: Pale bat. 1768 (25941) (IV) (purchased for World's Columbian Exposition).

Marsh, Charles W., Topeka, Kans.: Spider. 1397 (X).

Martin, John, & Company, Montreal, Canada: Two musk oxen. (Returned.) 1754 (IV).

May, William, Cooperstown, N. Y.: 2 specimens of moth. 1278 (X).

Mercer, R. W., Cincinnati, Ohio: 25 specimens of arrow-points made by Prof. J. C. Steele, of Wallula, Wash. (Returned.) 1434 (III).

Merchant, Rufus B., Fredericksburg, Va.: Insect. 1289 (X).

Mercier, W. G., Alpha, Wash.: Ore. (Returned.) 1403 (XVII).

Merrill, G. P. (See under Prof. W. J. Brown.)

Miles, William H., Salt Lake City, Utah: Clay. (Returned.) 1673 (XVII).

Miller, H. D., Plainville, Conn.: 2 specimens of mica and specimen of quartz crystal. 1485 (XVI).

Miller, J. S., Chewelah, Wash.: Ore. 1722 (XVII).

Miller, W., Grand Rapids, Mich.: Fossil shells and other material. 1619 (XIII-A).

Mirick, H. D., The Portland, Washington, D. C.: Samples of clay and shale. 1618 (XVII).

Monroe, Arthur B., Le Raysville, Pa.: Insect. 1766 (X).

Morehouse, F. A., Atlantic Highlands, N. J.: Stone implement found in Bethel, Conn. (Returned.) 1741 (III).

Moyers, F. H., Copp's Ford, Tenn.: Ore. (Returned.) 1426 (XVII).

Murch, Elmer F., Ellsworth, Me.: Birds' skins. 1617, 1746. (Returned.) (V-A).

Murn, Paul, Boulder, Mont.: Ore. 1638 (XVII).

Myers, A., Havre, Mont.: Insects. 1414 (X).

Narrin, Mrs. M. L., Goodrich, Mich.: 3 specimens of rocks. 1288 (XVII).

Navarre, I. A., Chelan, Wash.: Ore. 1596 (XVII).

Neal, Dr. James C., Lake City, Fla.: Minerals. 1312 (XVI).

Neefe, Miss Bessie, Sweden, Pa.: Insect. 1267 (X).

Nehring, Prof. A., Berlin, Germany: Specimens of a remarkable seed (fruit from the lower peatbogs of Klinge). 1751 (XV).

Nelson, William, Columbia, Va.: Specimen of supposed soapstone and a specimen of ore. 1339 (XVII).

Newlon, Dr. W. S., Oswego, Kans.: Mineral; doll's head supposed to have been found in bituminous coal; mammal bones; mineral or rock; fossil wood. 1291, 1487. (Returned.) 1549, 1649, 1709 (XVI, III, VIII, XVI, XIV).

Newport, Miss Eddie, Glasgow, Ky.: Living snake, sent with a view to purchase. 1446 (24894) (VI).

Ohl, H. C., Blairsville, Pa.: Owl, woodchuck, and partridge. (Returned.) 1529 (V-A).

Oliver, Stanley A., Texarkana, Ark.: Insect. 1749 (X).

Olney, A. M., Wyoming, R. I.: Worm found in the gizzard of a hen. 1731 (XI).

Orndorff, C., Mount Olive Post Office, Va.: Ore. 1248 (XVII).

Osburn, William, Nashville, Tenn.: Insects from Colorado. 1597 (X).

Overstreet, J. T., jr., Elmwood, Tenn.: Indian pipe. (Returned.) 1552 (III).

Overstreet, Robert L., Dade City, Fla.: Butterfly. 1728 (X).

Palmer, James, Grantsville, Utah: Ore from Eagle Mine, Skull Valley mining district. (Returned.) 1257 (XVII).

Peel, Hon. Samuel W., M. C. (See under Edward H. Dell.)

Pence, W. C., Shenandoah, Va.: Spider. 1353 (X).

Pennypacker, J. L., Haddonfield, N. J.: Stone implement. (Returned.) 1424 (III).

Perkins, F. S., Burlington, Wis.: 395 copper implements and perforated tooth of a bear. 1761 (III).

Perry, George W., State geologist, Rutland, Vt.: Teeth of mammal. (Returned.) 1359 (IV).

Picher, Miss Annie B., Pasadena, Cal.: Samples of Indian drawn-work, East Indian drawn-work, and Spanish drawn-work. 1465 (II-A).

Pisor, J. H., Horr, Mont.: Stones, rock. 1276 1726 (XVII).

Player, P. P., Bledsoe, Ala.: 2 specimens of ore. (Returned.) 1574 (XVII).

Pleas, C. E., Clinton, Ark.: 3 wasps. 1740 (X).

Porter & Butler, Baker City, Oregon: 2 specimens of stone. 1684 (XVII).

Powell, Dr. Tate, Starke, Fla.: Insect. 1444 (X).

Price, Samuel, Dunlap, Ariz.: 2 specimens of rock. 1702 (XVII).

Prindle, A. T., Ebensburg, Pa.: Giant water-bug. 1713 (X).

Proctor, J. C., U. S. National Museum: Insect. 1377 (X).

Quelch, Bertram, Wilmington, N. C.: 2 butterflies. 1332 (X).

Raber, Charles A., South Riverside, Cal.: Ore. (Returned.) 1573 (XVII).

Ragland, J. M., Osceola, Mo.: Mineral. 1526 (XVI).

Ragsdale, G. H., Gainesville, Tex.: Marine shells; 2 birds' skins. (Returned.) 1388 (V-A, IX).

Rathbun, Richard. (See under Col. Marshall McDonald.)

Rathfin, Jesse, West Fairview, Pa.: Insects. 1306 (X).

Rawlings, L. A., Box Elder, Colo.: Rock. (Returned.) 1661 (XVII).

Rawson, Frank, Judson, Ga.: Copper coin. (Returned.) 1259 (I).

Ray, Garrett, D., Burnsville, N. C.: Mineral. 1545 (XVI).

Remington, S. C., Phillipsburg, Mont.: Ore. (Returned.) 1563 (XVII).

Remsburg, George J., Oak Mills, Kans.: Fragments of bones found in a mound near Oak Hill. 1521 (III).

Rexward, Henry, Thomas, W. Va.: Mineral. 1284 (XVI).

Richardson, W. D., Fredericksburg, Va.: Insects. (Returned.) 1660 (X).

Richmond, Charles W., Greytown, Nicaragua: Bows and arrows; 2 archæological objects; mammal skin; birds' skins; birds' eggs; reptiles and batrachians; fishes; shells: insects: crustaceans; bone. (Purchased, with the exception of mammal skin, birds' eggs, and bone). 1692 (II-A, III, IV, V-A, V-B, VI, VII, IX, X, XI, XII). (The bone—sternum of Brown Pelican—was retained under accession 26460.)

Ricketts, Miss L. W., Baton Rouge, La.: Worm. 1418 (X).

Ridenour, Joseph, Buckton, Va: Insect. 1381 (X).

Ridenour, William B., Brooklyn, N. Y.: Subterranean fungi. 1404 (XV).

Rider, I. I., Granite Cañon, Wyo.: Water insects. 1714 (25779) (X).

Roberts, P. H., Graball, Tex.: Medal supposed to have belonged to La Salle, which was lost in Montgomery County, Tex., and recently found while plowing. (Returned.) 1517 (I).

Robinson, S. A., Orlando, Fla.: Small fossils; samples of phosphatic deposits. 1473, 1628 (XII, XVI).

Rogan, James W., Rogersville, Tenn.: Bird in the flesh. 1469 (XII).

Rogers, Archibald, Hyde Park on Hudson, N. Y.: Collection of drawings by George Catlin. (Returned.) 1667 (I).

Rogers, O. P., Marengo, Ill.: Supposed meteoric iron and bog-iron ore. 1514 (XVI).

Romeyn, Capt. Henry, U. S. A., Mount Vernon, Ala.: Specimen of supposed poisonous spider. 1317 (X).

Rosborough, J. B., Aransas Pass, Tex.: Rock deposits and soil. 1453 (XVII).

Rosenthal, Joseph, New York City, N. Y.: 6 skins of Birds of Paradise. 1254 (24589) (V-A).

Rothenflue, Peter U., San Antonio, Tex.: Violin. (Returned.) 1336 (I).

Rowe, C. H., Worcester, Mass.: Five lots of insects. (Returned.) 1474, 1582, 1643, 1705, 1763 (X).

Ruggles, Charles, Bronson, Mich.: Ivory implement from near Orland, Ind. (Returned.) 1584 (III).

Sampsell, Miss Addie, New Orleans, La.: Insect. 1506 (X).

Sanders, A. G., Sanders, Cal.: Plants. 1507 (XV).

Sandford, J. W. A., jr., Montgomery, Ala.: Butterfly. 1401 (X).

Scherr, Julius, Eglon, W. Va.: Mineral. 1644 (XVI).

Schramm, Ernst, Leavenworth, Kans.: Insect. 1347 (X).

Science College, Imperial University, Tokio, Japan, through Prof. I. Ijima: 68 Japanese birds. 1712 (V-A).

Shaffer, A. W., Raleigh, N. C.: Fragment of feldspar. 1479 (XVII).

Shannon, W. W., Clay Lick, Ohio.: Small image from a mound on Flint Ridge. (Returned.) 1539 (III).

Sharp, Dr. D. (See under British Museum.)

Shearer, Mrs. R. A., Stofiel, Nev.: Insects. 1372, 1496, 1525 (X).

Shelton, J. C., Roseland, Va.: Minerals. 1416 (XVI).

Shott, W. C., M. A., Principal of New Philadelphia Business College, New Philadelphia, Ohio: Butterfly. 1256 (X).

Shumaker, P. F., Flat Creek, La.: Sample of black and white sand. 1683 (XVII).

Simpson, A. M., Forman, N. Dak.: Cocoons taken from box elder trees. 1676 (X).

Simpson, Stewart, Ruthburg, Idaho: Rock. 1715 (XVII).

Sinaw, William, Eutaw, Ala.: 3 stone implements. 1698 (III).

Sivyer, Leonard D., Spokane, Wash.: Ore. (Returned.) 1579 (XVII).

Slocum, J. W., Knoxville, Tenn.: Mineral. 1730 (XVI).

Smith, A. M., Minneapolis, Minn.: Collection of American colonial coins and paper money. (The larger part of this collection was returned.) 1743 (I).

Smith, B. O., Lyerly, Ga.: Minerals. 1311 (XVI).

Smith, Charles N., Bell Branch, Mich.: 5 archæological objects. (Returned.) 1707 (III).

Smith, Mrs. E. L., La Plata, N. Mex.: Stone and an ornament made of stone. (Returned.) 1699 (XVII).

Smith, G. A., Liberty, Tenn.: Insect. 1428 (X).

Smith, Harlan I., Saginaw, Mich.: Alcoholic specimen of a portion of the leg of a water amphibian, covered with a peculiar growth; alcoholic specimens of some parts of crayfish with parasites attached. 1735 (XV).

Index to list of specimens sent for examination and report, arranged geographically.

Source.	No. of lot.	Total.
North America:		
British America	1350, 1495, 1688, 1090, 1754, 1757	6
Central America	1692	1
Mexico	1385, 1409. 1536, 1590. 1716	5
United States:		
Alabama	1317, 1367. 1401, 1574. 1637. 1681, 1698	7
Arizona	1468, 1475. 1523, 1553, 1592. 1645, 1702, 1756. 1770	9
Arkansas	1300, 1435. 1447, 1521, 1564, 1636, 1647, 1740. 1749. 1758	10
California	1313, 1318, 1325, 1331, 1406, 1421, 1441, 1465, 1480, 1507, 1547, 1573, 1583, 1616, 1620, 1625, 1677, 1693, 1719, 1768.	20
Colorado	1253, 1466, 1493, 1541, 1597, 1661, 1687	7
Connecticut	1268, 1485, 1503, 1657, 1741	5
Delaware	1557	1
District of Columbia	1302, 1328, 1377, 1462, 1589, 1618, 1642	7
Florida	1312, 1323, 1370, 1427, 1444, 1448, 1464, 1467,1473, 1518, 1533, 1588, 1628, 1671, 1728. 1739.	16
Georgia	1259, 1273, 1311, 1398, 1050, 1772	6
Idaho	1272. 1431. 1432, 1648, 1689, 1715, 1752	7
Illinois	1258, 1290, 1321, 1366. 1497, 1504, 1514, 1542, 1558, 1577,1654, 1659.	12
Indian Territory	1433, 1463, 1483, 1567	4
Indiana	1249, 1314, 1363, 1400, 1437, 1445, 1540. 1584, 1701, 1724	10
Iowa	1250, 1264, 1274, 1280. 1298. 1315, 1481. 1498, 1519, 1626	10
Kansas	1291, 1347, 1373, 1397. 1487, 1502, 1512, 1530, 1549, 1649, 1700, 1709, 1711.	13
Kentucky	1355, 1446, 1486, 1516, 1621, 1682, 1760	7
Louisiana	1260, 1418. 1506, 1683, 1748	5
Maine	1262, 1271, 1455, 1494, 1569, 1571, 1617, 1746	8
Maryland	1376, 1395, 1478. 1640, 1666, 1734	6
Massachusetts	1408, 1413, 1474, 1582, 1624. 1643, 1705, 1763	8
Michigan	1288. 1458, 1619, 1707, 1729, 1735	6
Minnesota	1358, 1407, 1411, 1635. 1743	5
Mississippi	1371, 1591, 1601, 1606. 1641. 1720	6
Missouri	1269, 1304, 1472, 1526, 1555, 1570, 1585, 1704. 1747. 1771	10
Montana	1276, 1386, 1414, 1420, 1456. 1537, 1546, 1561, 1563, 1568, 1586, 1600, 1638, 1663, 1674. 1726. 1745, 1762.	18
Nebraska	1263. 1285, 1375, 1402, 1658	5
Nevada	1372. 1496. 1525	3
New Jersey	1305, 1319, 1399, 1424, 1425, 1457, 1484, 1500	8
New Mexico	1251, 1265, 1442, 1491, 1499, 1551, 1595, 1699	8
New York	1254, 1277, 1278, 1296, 1297, 1337, 1342. 1344, 1346, 1351, 1404, 1524, 1543, 1556, 1608, 1614, 1623. 1631. 1634, 1655, 1669, 1667, 1670, 1679, 1703, 1727. 1738.	27
North Carolina	1295, 1324, 1332, 1335, 1352, 1379, 1383. 1392. 1439, 1479, 1501, 1513, 1544, 1545, 1565, 1587. 1604, 1733, 1737, 1742, 1755, 1774.	22
North Dakota	1415, 1676	2
Ohio	1255, 1256. 1281, 1286, 1303, 1309, 1326, 1362, 1387, 1412, 1454, 1528, 1539, 1560, 1562, 1598, 1632, 1706.	18
Oklahoma Territory	1575, 1652	2
Oregon	1356. 1382, 1391, 1684, 1710, 1769	6
Pennsylvania	1252, 1267, 1279, 1294, 1306, 1310, 1329, 1341, 1345, 1361, 1470, 1477, 1505, 1522, 1529, 1534. 1566, 1578, 1593, 1599, 1639. 1680, 1695, 1713, 1766.	25

Index to list of specimens sent for examination and report, arranged geographically—Continued.

Source.	No. of lot.	Total.
Rhode Island	1731	1
South Carolina	1266, 1275, 1334, 1364, 1365,* 1490, 1538, 1581, 1607, 1610, 1611	11
South Dakota	1333, 1410, 1515, 1609, 1629	5
Tennessee	1292, 1327, 1426, 1428, 1469, 1532, 1552, 1572, 1576, 1612, 1627, 1633, 1668, 1691, 1697, 1723, 1725, 1730, 1736.	19
Texas	1293, 1320, 1336, 1349, 1374, 1388, 1390, 1440, 1452, 1453, 1517, 1548, 1559, 1603, 1030, 1672, 1686, 1696, 1708, 1732.	20
Utah	1257, 1389, 1422, 1510, 1580, 1615, 1653, 1656, 1673, 1675, 1678, 1694, 1744.	13
Vermont	1359	1
Virginia	1248, 1261, 1282, 1283, 1287, 1289, 1307, 1322, 1330, 1339, 1348, 1353, 1354, 1378, 1381, 1393, 1396, 1416, 1417, 1443, 1450, 1460, 1476, 1488, 1492, 1508, 1511, 1520, 1527, 1550, 1605, 1613, 1660, 1665, 1685, 1721, 1750, 1764, 1773.	39
Washington	1301, 1308, 1340, 1343, 1357, 1360, 1403, 1419, 1430, 1434, 1436, 1451, 1459, 1461, 1509, 1579, 1596, 1051, 1664, 1718, 1722, 1753, 1765.	23
West Virginia	1270, 1284, 1369, 1380, 1384, 1423, 1482, 1531, 1022, 1644, 1662, 1759, 1767.	13
Wisconsin	1299, 1338, 1395, 1429, 1449, 1554, 1602, 1717, 1761	9
Wyoming	1438, 1714	2
From unknown locality	1646	1
West Indies	1471	1
	1316	1
South America:		
Peru	1405	1
Europe, including—		
Great Britain	1535	1
France	1368	1
Germany	1489, 1751	2
Italy	1489, 1594	2
Poland	1489	1
Asia:		
Japan	1712	1

FOREIGN EXCHANGES.

Exchanges of specimens with foreign museums has been continued during the year, with results as given below. The "domestic" exchanges are indicated in the "Accession List" (Section V).

ETHNOLOGY.

From the British Museum, London, England, have been received four throwing-sticks from Australia, for which ethnological objects have been sent in return.

From the Royal Zoölogical Museum,* Florence, Italy (through Prof. Henry H. Giglioli, director), has been received a collection of ethnological objects obtained principally from New Guinea, for which an equivalent has been sent. A very valuable and interesting collection of objects from the Andaman Islands, has been promised by Prof. Giglioli.

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* Other parts of the collection received from this museum are referred to under Prehistoric Anthropology and Marine Invertebrates.

The Icelandic Natural History Society (through Mr. B. Gröndal, president) transmitted articles of clothing forming part of a woman's costume, and carved wooden vessels used for food, in return for a collection of marine invertebrates.

Casts of Easter Island tablets have been sent to Dr. A. B. Meyer, director of the Royal Zoölogical and Anthropological-Ethnographical Museum, Dresden, Germany, for which an equivalent has been promised.

PREHISTORIC ANTHROPOLOGY.

Mr. Henry Balfour, The Museum, Oxford, England, has sent several flint cores, paleolithic implements, scrapers and hatchets. Five specimens of candle-fish (*Thaleichthys pacificus*) have been transmitted to Mr. Balfour.

A collection of archæological objects from France, Italy, Egypt, British Honduras, and a few from the Andaman Islands (not forming a part of the collection referred to under Ethnology), have been received from Prof. Henry Giglioli, director of the Royal Zoölogical Museum, Florence, Italy.

Mr. Edward Lovett, Croydon, England, transmitted a number of paleolithic implements and worked flints from various parts of England, for which an equivalent has been sent.

Thirty-seven objects relating to prehistoric anthropology have been received from Dr. Paolo Mantegazza, director of the National Museum of Anthropology, Florence, Italy, for which fifty-five similar specimens have been returned.

MAMMALS.

From the British Museum, London, England (through Dr. Henry Woodward) were received four teeth of a mammoth, *Elephas primigenius*.

The skin and model of skull of a California sea-lion have been sent to Dr. Robert Collett, director of the Zoölogical Museum, Christiania, Norway, in return for specimens already received.

From the Australian Museum, Sydney, New South Wales (through Dr. Edward P. Ramsey, curator), has been received a very fine collection of marsupials, in continuation of an exchange.

The Auckland Museum, Auckland, New Zealand (through Prof. T. F. Cheeseman, director), transmitted birds' skeletons in return for a collection sent by the museum.

From the Museum of Natural History, Paris, France (through Dr.

E. Beauregard), have been received mammal skins, birds' skeletons, and an alcoholic specimen of Chimpanzee, in continuation of an exchange.

BIRDS.

A collection of birds' skins has been sent to Mr. H. E. Dresser, London, England, for which an equivalent has been promised.

From Rev. Henry B. Tristram, The College, Durham, England, have been received birds' skins from New Guinea, New Caledonia, New Hebrides, and Fiji Islands, for which similar specimens have been sent.

Birds' skins have been sent from the Auckland Museum, Auckland, New Zealand (through Prof. T. F. Cheeseman), in return for specimens already transmitted by the National Müseum.

From the Museum of Natural History, Paris, France (through Dr. E. Beauregard), have been received birds' skins from Madagascar, the Philippine and adjacent islands, in continuation of an exchange.

From the Australian Museum, Sydney, New South Wales (through Dr. Edward P. Ramsay, curator), have been received birds' skins, in continuation of exchanges.

FISHES.

Thirty-seven species of deep-sea fishes were sent to the Royal Zoölogical Museum, Copenhagen, Denmark (Prof. Dr. C. Lütken, director), in return for specimens already received.

MOLLUSKS.

From Mr. C. F. Ancey, Boghari, Algeria, have been received very fine specimens of African shells, for which an equivalent will be sent.

Mr. M. Cossman, Paris, France, transmitted Tertiary fossils from the Paris basin, France (the first installment), in return for Claiborne shell-marl already transmitted by the National Museum.

Mr. Hugh Fulton, London, England, transmitted specimens of *Voluta aulica* L, from the Indo-Pacific Ocean. Specimens of *Turcicula Bairdii* have been sent to Mr. Fulton in return for specimens already received.

Specimens of shell-marl from Claiborne, Ala., have been sent to Mr. G. F. Harris, London, England, for which European Miocene fossils have beeen promised in return.

Mr. William Moss, Ashton-under-Lyne, England, has transmitted specimens of *Bulimus acutus*, with microscopic slides; specimens showing serrated organ and details, and 12 microscopical slides showing dentition of British mollusks, in return for publications sent.

INSECTS.

From Dr. William Eichhoff, Strasburg, Germany, have been received typical specimens representing species of North American and exotic

Scolytidæ, all new to the collection, for which an equivalent has been sent.

Mr. Paul Noël, Rouen, France, has sent specimens of European insects, for which an equivalant will be transmitted.

From the Auckland Museum, Auckland, New Zealand (through Prof. T. F. Cheeseman, director), have been received specimens of insects in return for specimens already sent.

MARINE INVERTEBRATES.

From Prof. George S. Brady, Mowbray Villa, Sunderland, England, have been received specimens of British fresh-water *Cyclopidæ*, in exchange for echinoderms and corals already sent.

From the Royal Zoölogical Museum, Florence, Italy (through Prof. Henry Giglioli, director), have been received sponges from the banks of the Lampedusa, for which an equivalent has been sent.

Specimens, representing 22 species of European *Paguridæ* and *Pycnogonida* have been transmitted by Rev. A. M. Norman, Durham, England, in return for specimens of *Pycnogonida* already sent.

The Otago University Museum, Dunedin, New Zealand (through Prof. T. Jeffrey Parker), transmitted specimens of crustaceans, for which crinoids and specimens of *Nesturus* and *Amblystoma* have been sent as an equivalent.

From the Australian Museum, Sydney, New South Wales (through Dr. Edward P. Ramsay, curator), have been received specimens of crustaceans and asteroidea; also specimens of echinoderms. Echinoderms have been sent in exchange for those received.

Crustaceans and radiates have been transmitted to the Royal Zoölogical Museum, Copenhagen (Prof. Dr. C. Lütken, director), in return for specimens which have been received.

INVERTEBRATE FOSSILS (PALEOZOIC).

A collection of graptolites have been received from the Australian Museum, Sydney, New South Wales (through Dr. Edward P. Ramsay, curator), for which a similar collection will be returned.

Mr. L. Tornquist, Lund, Sweden, transmitted specimens of graptolites, in exchange for specimens of similar nature previously sent.

FOSSIL PLANTS.

Prof. Dr. A. Nehring, Berlin, Germany, transmitted specimens of *Cratopleura helvetica* Nehring, for which an equivalent in seeds has been sent.

From the Royal Swedish Academy of Sciences, Stockholm, Sweden, have been received specimens of Siberian Phanerogams, for which an equivalent will be sent.

BOTANY.

Botanical specimens have been received from the Auckland Museum, Auckland, New Zealand (through Prof. T. F. Cheeseman, director), for which an equivalent has been sent.

MINERALS.

Prof. A. Streng, Giessen, Germany, transmitted minerals, for which an equivalent will be sent.

GEOLOGY.

Mr. R. N. Worth, Plymouth, England, transmitted ores and geological material in exchange for specimens already sent.

PUBLICATIONS.

The public demand for the publications of the Museum is constantly increasing, but comparatively few applications can be favorably considered on account of the very limited appropriation for printing. Some years ago both the Proceedings and Bulletins of the Museum were reprinted by the Smithsonian Institution in its Miscellaneous Collections. By this means it was possible to supply a large number of libraries with these publications. The Institution has, however, for several years ceased to do this. The entire distribution of these publications now falls upon the Museum, and with an edition of only 3,000 copies of the Proceedings and of the Bulletins, it is evident that a large number of deserving libraries must be excluded from the mailing-list, as well as many students to whom these volumes would be of great assistance.

REPORTS OF THE NATIONAL MUSEUM.

During the year the Report for 1889 was distributed. This volume contains the following papers:

1. The museums of the future. By G. Brown Goode.
2. Te Pito Te Henua, or Easter Island. By William J. Thomson, paymaster, U. S. Navy.
3. Aboriginal skin dressing; a study based on material in the U. S. National Museum. By Otis T. Mason.
4. The puma, or American lion (*Felis concolor* of Linnaeus). By Frederick W. True.
5. Animals recently extinct, or threatened with extermination, as represented in the collection of the U. S. National Museum. By Frederic A. Lucas.
6. The development of the American rail and track, as illustrated by the collection in the U. S. National Museum. By J. Elfreth Watkins.
7. Explorations in Newfoundland and Labrador in 1887, made in connection with the cruise of the U. S. Fish Commission Schooner *Grampus*. By Frederic A. Lucas.
8. On a bronze Buddha in the U. S. National Museum (reprint). By Charles De Kay.

The manuscript of the reports for 1890 and 1891 has been transmitted to the Public Printer.

PROCEEDINGS OF THE NATIONAL MUSEUM.

Volume XIII (1890) of the Proceedings, embracing separates 790 to 841, was issued during the year. This volume contains 665 pages, with 38 plates and 11 text-figures. A list of the titles of the separate papers is given on pp. 61, 62 of the Report for 1891. A table containing an enumeration of the papers by subjects is given on p. 63 of that Report.

All the papers constituting Volume XIV of the Proceedings and embracing numbers 842–886, inclusive, have been published separately during the year. A list of these papers is here given by title:

No. 842. Catalogue of the fresh-water fishes of South America. By Carl H. Eigenmann and Rosa S. Eigenmann. Pp. 1–81.

No. 843. Fishes collected by William P. Seal in Chesapeake Bay at Cape Charles City, Va., September 16 to October 3, 1890. By Barton A. Bean. Pp. 83–94.

No. 844. List of North American land and fresh-water shells received from the U. S. Department of Agriculture, with notes and comments thereon. By Robert E. C. Stearns, Pp. 96–106.

No. 845. Relations of temperature to vertebræ among fishes. By David Starr Jordan. Pp. 107–120.

No. 846. Report upon a collection of fishes made at Guaymas, Sonora, Mexico, with descriptions of new species. By Barton W. Evermann and Oliver P. Jenkins. Pp. 121–165.

No. 847. Description of a new genus and species of tailless batrachian, from tropical America. By Leonhard Stejneger and Frederick C. Test. Pp. 167, 168.

No. 848. On the structure of the tongue in humming birds. By Frederic A. Lucas. Pp. 169–172.

No. 849. On some new or interesting West American shells, obtained from the dredgings of the U. S. Fish Commission steamer *Albatross* in 1888, and from other sources. By William H. Dall. Pp. 173–191.

No. 850. Descriptions of two supposed species of mice from Costa Rica and Mexico, with remarks on *Hesperomys melanophrys* of Coues. By J. A. Allen. Pp. 193–195.

No. 851. Contributions toward a monograph of the *Noctuidæ* of temperate North America. Revision of *Mamestra*. By John B. Smith. Pp. 197–276.

No. 852. Report upon the *Annelida polychæta* of Beaufort, N. C. By E. A. Andrews. Pp. 277–302.

No. 853. On *Eleginus* of Fischer, otherwise called *Tilesia* or *Pleurogadus*. By Theodore A. Gill, M. D., PH. D. Pp. 303–305.

No. 854. List of shells collected on the west coast of South America, principally between latitudes 7° 30′ S. and 8° 49′ N., by Dr. W. H. Jones, surgeon, U. S. Navy. By Robert E. C. Stearns. Pp. 307–335.

No. 855. Description of new genera, species, and subspecies of birds from Costa Rica. By George K. Cherrie. Pp. 337–346.

No. 856. Description of apodal fishes from the tropical Pacific. By Charles H. Gilbert. Pp. 347–352.

No. 857. Description of a new species of chameleon from Kilima-Njaro, eastern Africa. By Leonhard Stejneger. P. 353.

No. 858. The genus *Panopeus*. By James E. Benedict and Mary J. Rathbun. Pp. 355–385.

No. 859. Some observations on the Havesu-Pai Indians. By R. W. Shufeldt. Pp. 387–390.

No. 860. The Navajo belt-weaver. By R. W. Shufeldt. Pp. 391–393.

No. 861. On the genera *Labrichthys* and *Pseudolabrus*. By Theodore Gill. Pp. 395–404.
No. 862. Description of a new scincoid lizard from East Africa. By Leonhard Stejneger. P. 405.
No. 863. Description of a new species of lizard from the Island San Pedro Martir, Gulf of California. By Leonhard Stejneger. P. 407.
No. 864. Description of a new North American lizard of the genus *Sauromalus*. By Leonhard Stejneger. Pp. 409–411.
No. 865. Notes on and a list of birds and eggs collected in Arctic America, 1861–1866. By R. MacFarlane. Pp. 413–446.
No. 866. On the characters of some paleozoic fishes. By E. D. Cope. Pp. 447–463.
No. 867. Description of a new species of whip-poor-will from Costa Rica. By Robert Ridgway. Pp. 465, 466.
No. 868. Notes on some birds from the interior of Honduras. By Robert Ridgway. Pp. 467–471.
No. 869. Notes on some Costa Rican birds. By Robert Ridgway. Pp. 473–478.
No. 870. Note on *Pachyrhampus albinucha* Burmeister. By Robert Ridgway. Pp. 479, 480.
No. 871. Description of two supposed new forms of *Thamnophilus*. By Robert Ridgway. P. 481.
No. 872. Description of a new sharp-tailed sparrow from California. By Robert Ridgway. Pp. 483, 484.
No. 873. Notes on *Sceloporus variabilis* and its geographical distribution in the United States. By Leonhard Stejneger. Pp. 485-488.
No. 874. Notes on the Japanese birds contained in the Science College, Imperial University, Tokyo, Japan. By Leonhard Stejneger. Pp. 489–498.
No. 875. Notes on the cubital coverts in the birds of paradise and bower birds. By Leonhard Stejneger. Pp. 499, 500.
No. 876. Notes on some North American snakes. By Leonhard Stejneger. Pp. 501-505.
No. 877. Note on the genus *Sittasomus* of Swainson. By Robert Ridgway. Pp. 507–510.
No. 878. On the snakes of the Californian genus *Lichanura*. By Leonhard Stejneger. Pp. 511–515.
No. 879. Notes on Costa Rican birds. By George K. Cherrie. Pp. 517–537.
No. 880. Scientific results of explorations by the U. S. Fish Commission Steamer *Albatross*. No. XXII. Descriptions of thirty-four new species of fishes collected in 1888 and 1889, principally among the Santa Barbara Islands and in the Gulf of California. By Charles H. Gilbert. Pp. 539–566.
No. 881. The biology of the hymenopterous insects of the family *Chalcididæ*. By L. O. Howard. Pp. 567–588.
No. 882. A critical review of the characters and variations of the snakes of North America. By E. D. Cope. Pp. 589–694.
No. 883. Note on the genus *Hiatula* of Lacépède or *Tautoga* of Mitchill. By Theodore Gill. P. 695.
No. 884. Note on the genus *Chonerhinus* or *Xenopterus*. By Theodore Gill. Pp. 697–699.
No. 885. On the genus *Gnathanacanthus* of Bleeker. By Theodore Gill. Pp. 701–704.
No. 886. Notes on the *Tetraodontoidea*. By Theodore Gill. Pp. 705–720.

Of Volume XV the following papers were issued separately during the year:

No. 887. Preliminary descriptions of thirty-seven new species of hermit crabs of the genus *Eupagurus* in the U. S. National Museum. By James E. Benedict. Pp. 1–26.
No. 888. Description of two apparently new flycatchers from Costa Rica. By George K. Cherrie. Pp. 27, 28.

BULLETIN OF THE NATIONAL MUSEUM.

Of the Bulletin, Parts A to E of No. 39 have been issued. This Bulletin is published in separate pamphlets, each one containing instructions to collectors in some special department of natural history. The manuscripts of Parts F (Directions for Collecting and Preserving Insects) and G (Instructions for Collecting Mollusks, and other Useful Hints for the Conchologist) have been transmitted to the Public Printer. It is hoped that this series of instructions to collectors will prove of service to naturalists and others engaged in making natural history collections. It is probable that before very long additional contributions to this series will be made, containing suggestions to collectors in other branches of natural history.

In addition, No. 41, Bibliography of Dr. Charles Girard, and No. 42, A Preliminary Descriptive Catalogue of the Systematic Collections in Economic Geology and Metallurgy in the National Museum, by Mr. F. P. Dewey, have been published. The manuscript of Bulletin No. 40, Bibliography of George N. Lawrence, by Dr. G. Brown Goode, has been temporarily withdrawn.

In order to meet special requirements in connection with the description of certain valuable collections in the National Museum, it has been decided to issue, from time to time, monographs of collections in quarto form. This series of publications will be known as the "Special Bulletin." During the year, No. 1 of this series, entitled "Life Histories of North American Birds," has been issued. This book has been prepared by Charles E. Bendire, U. S. Army, honorary curator of the department of birds' eggs in the U. S. National Museum. It is based largely upon the collections in the Museum. The preparation of this book was commenced in accordance with the wishes of Professor Baird. The present volume relates only to land birds. It is hoped that before long Capt. Bendire will be enabled to prepare for publication subsequent volumes relating to the same general subject.

A large number of papers upon scientific subjects has been published by officers of the Museum and other specialists. These are, for the most part, based on collections in the museum, and are referred to by title in the Bibliography, constituting Section IV of this report. The authors of these papers are seventy-five in number, thirty-two of whom are connected with the Smithsonian Institution or the National Museum. The papers referred to in the Bibliography number 238, and relate to the following subjects:

Subject.	By officers of the Museum.	By investigators not officially connected with the Museum.
Administration	3	
Biography	1	
Birds	6	18
Ethnology	9	
Exploration	3	1
Fishes	18	6
Fossils	17	1
Geology		2
Graphic arts	2	
History	2	
Mammals	4	
Marine invertebrates	4	10
Minerals	30	
Mollusks	15	1
Oriental antiquities	1	
Prehistoric anthropology	9	
Recent plants	12	27
Reptiles and batrachians	15	4
Transportation	8	
Miscellaneous	7	2
Total	166	72

VISITORS.

During the year the total number of visitors to the Museum building was 269,825, and to the Smithsonian Institution, 114,817.

The monthly register of visitors is as follows:

Year and month.	National Museum building.	Smithsonian building.
1891:		
July	20,415	8,350
August	24,933	9,856
September	26,977	9,552
October	22,387	9,331
November	17,520	7,038
December	20,982	9,089
1892:		
January	15,459	7,185
February	25,758	10,738
March	22,453	9,706
April	29,390	10,716
May	26,397	16,215
June	17,152	7,130
Total	269,825	114,817
Approximate daily average on a basis of 313 days in the year	862	367

Since 1881 a careful record of visitors to the Museum and Smithsonian buildings has been kept. The results up to June 30, 1892, are here presented:

Year.	Museum building.	Smithsonian building.	Total to both buildings.
1881	150, 000	....	150, 000
1882	167, 455	152, 744	320, 199
1883	202, 188	104, 823	307, 011
1884	195, 322	91, 130	286, 452
1885 (January-June)	107, 365	60, 428	167, 793
1885-'86	174, 225	88, 960	263, 185
1886-'87	216, 562	98, 552	315, 114
1887-'88	249, 665	102, 863	352, 528
1888-'89	374, 843	149, 618	524, 461
1889-'90	274, 324	120, 894	395, 218
1890-'91	286. 426	111, 669	398, 095
1891-'92	269. 825	114, 817	384, 642
Total	2, 668, 200	1, 196. 498	3. 864, 698

LECTURES AND MEETINGS OF SOCIETIES.

As in previous years, the use of the lecture hall has been granted for lectures and meetings of societies. Lectures have been held under the auspices of the National Geographic Society as follows:

December 30, 1891.—Peary and the West Greenland expedition. By Dr. Benjamin Sharp.

February 26, 1892.—Military surveying during the civil war. By Mr. Gilbert Thompson and Maj. Joel Hotchkiss.

March 18.—Coon Mountain, Arizona, and the Diablo meteorites. By Mr. G. K. Gilbert.

March 25.—Greece and Palestine. My Mr. W. A. Croffut.

April 1.—The cruise of the *Albatross* through the Straits of Magellan. By Prof. Leslie A. Lee.

April 8.—A trip through Bolivia. By Lieut. C. H. Harlow, U. S. Navy.

April 15.—The Cliff Dwellers. By Mr. W. H. Holmes.

April 22.—The Challenger Expedition, with some of its scientific results. By Prof. John Murray.

May 13.—The gates and straits of Europe and Africa. By Mr. Talcott Williams.

The following meetings of associations and scientific societies have been held: The American Pomological Association, September 23; the American Historical Association (eighth annual meeting), December 30; the American Forestry Association, December 30; the American Geographical Association, December 30; the National Association of Dairy and Food Commissioners, March 30 and 31; the National Academy of Sciences, April 19-22.

At the meeting of the National Academy of Sciences the following papers were presented:

An American Maar. G. K. Gilbert.

The form and efficiency of the iced bar base apparatus of the U. S. Coast and Geodetic Survey. R. S. Woodward.

On Atmospheric Radiation of Heat in Meteorology. C. Abbe.

On the Deflecting Forces that Produce the Diurnal Variation of the Normal Terrestrial Magnetic Field. F. H. Bigelow.

Abstract of Results from the U. S. Coast and Geodetic Survey Magnetic Observatory at Los Angeles, Cal., 1882-1889, Part III. Differential Measures of the Horizontal Component of the Magnetic Force. C. A. Schott.

On the Anatomy and Systematic Position of the Mecoptera. A. S. Packard.

On the Laws of the Variation of Latitude. S. C. Chandler.

On the Causes of Variations of Period in the Variable Stars. S. C. Chandler.

On the Force of Gravity at Washington. T. C. Mendenhall.

On the Recent Variations of Latitude at Washington. T. C. Mendenhall.

On the Acoustic Properties of Aluminum, with experimental illustrations. A. M. Mayer.

Disruption of the Silver Haloid Molecule by Mechanical Force. M. Carey Lea.

On the Homologies of the Cranial Arches of the Reptilia. E. D. Cope.

On the Osteology of the genus *Anniella*. E. D. Cope.

The Astronomical, Geodetic and Electrical Consequences of Tidal Strains within an Elastic Terrestrial Spheroid. C. Abbe.

Asiatic Influences in Europe. E. S. Morse.

Exhibition of Chladni's Acoustic Figures transferred to paper without distortion. A. M. Mayer.

On Electrical Discharges through poor vacua, and on Coronoidal Discharges. M. I. Pupin.

Biographical Memoir of William Ferrel. C. Abbe.

A definition of Institutions. J. W. Powell.

Several other societies held their annual meeting in Washington. Among them may be mentioned the National Art Association, May 16–30; American Microscopical Society, August 11, 12; Association of American Agricultural Colleges and Experiment Stations, August 12–15; Association of Official Agricultural Chemists, August 13, 15; Society for the Promotion of Agricultural Sciences, August 17, 18; Washington Chemical Society, August 17, 18; Geological Society of America, August 23, 24; International Congress of Geologists, August 25–September 1; American Association for the Advancement of Science, August 17–September 2.

STUDENTS.

During the past year, as heretofore, the National Museum has continued to aid students and others engaged in scientific work by lending them material to be used in connection with their researches. Among the more important loans made during the year are the following: A specimen of *Maia* to Mr. J. E. Ives, of the Philadelphia Academy of Natural Sciences. Pieces of Gorgonians and sponges for microscopic work to Mr. G. R. Lumsden, Greeneville, Conn. Crayfishes, from Lake Chapala, Mexico, to Prof. Walter Faxon, Museum of Comparative Zoölogy, Cambridge, Mass. An example of *Dendroica pityophila* to Mr. C. B. Cory, Boston, Mass. Central American birds to Mr. Osbert Salvin, London, England. Turtles to Dr. G. Baur, Clark University, Worcester, Mass. Anatomical specimens to Prof. R. Wiedersheim, Freiburg, Germany. Anatomical specimens to Mr. W. B. Barrows, Department of Agriculture, Washington. Skins and skulls of *Capromys* to Dr. J. A. Allen, New York City. Skeletons of Fruit Bats to Dr. Harrison Allen, Philadelphia, Pa. A series of California *Hemiptera-heteroptera* to Prof. A. L. Montandon, Bucharest, Roumania. A fossil plant, *Zamiostrobus mirabilis*, to Prof. H. Graf zu Solms-Laubach, University of Strasburg, Germany. Material has also been furnished to the Bering Sea Commission, in connection with its investigations concerning the fur-seal.

During the session of the International Congress, in August, many of the leading paleontologists and geologists of Europe examined the collections of the Museum. Dr. O. P. Hay, of Irvington, Ind., spent some time studying the Indiana reptiles and batrachians. Prof. R. L. Packard availed himself of the opportunities offered for study in the department of geology during a portion of the year, and has rendered valuable service in determinative and analytical work. Dr. G. Baur, of Clark University, Worcester, Mass., has examined the collection of Chelonians.

FINANCE, PROPERTY, SUPPLIES, AND ACCOUNTS.

The statements relating to these branches of the administrative work have been prepared by Mr. W. V. Cox, chief clerk.

The appropriations made by Congress in behalf of the U. S. National Museum for the fiscal year ending June 30, 1892, are as follows:

For continuing the preservation, exhibition, and increase of the collections from the surveying and exploring expeditions of the Government, and from other sources, including salaries or compensation of all necessary employés, $145,000.

For cases, furniture, fixtures, and appliances required for the exhibition and safe keeping of the collections of the National Museum, including salaries or compensation of all necessary employés, $25,000.

For the expense of heating, lighting, electrical, telegraphic, and telephonic service for the National Museum, $12,000.

For removing the old boilers under the Museum hall in the Smithsonian building, and replacing them with new ones, and for necessary alterations and connections of steam-heating apparatus, and for covering pipes with fire-proof material, $3,000.

For removing decayed wooden floors in the Museum building, substituting granolithic or artificial stone therefor, and for slate for covering trenches containing heating and electrical apparatus, including all necessary material and labor, to be immediately available, $5,000.

For the Smithsonian Institution, for printing labels and blanks, and for the bulletins and annual volumes of the proceedings of the National Museum, $15,000.

For postage stamps and foreign postal cards for the National Museum, $500.

PRESERVATION OF COLLECTIONS.

At the time of submitting the report for 1891 from this office, the unexpended balance of the appropriation for the preservation of collections held to meet liabilities contracted during the fiscal year ending June 30, 1891, was $7,979.99. Since then bills have been vouchered and paid as follows: $489.93 have been expended for services; $1,079.37 for supplies; $4,191.51 for specimens; $768.15 for books; $420.46 for stationery; $273.04 for travel; $465.95 for freight, making a total of $7,688.41, and leaving an unexpended balance July, 1892, of $291.58, to settle an account of Elkington & Company, London, and to meet a few other small bills still outstanding.

From the appropriation of $145,000 for the fiscal year ending June 30, 1892, the disbursements are as follows:

For salaries or compensation, $119,911.79; for special or contract services, $2,839.64; for specimens, $6,340.12; for general supplies, $2,038.76; for freight and cartage, $2,180.95; for travel, $1,574.81; for stationery, $842.79; for books and periodicals, $453; a total of $136.181.86, which leaves an unexpended balance of $8,818.14, July 1, 1892, to meet outstanding liabilities.

FURNITURE AND FIXTURES.

The unexpended balance of the appropriation for furniture and fixtures for 1891, held to meet liabilities contracted during that fiscal year, was $3,690.54. The following bills have been vouchered and paid from this balance: One thousand one hundred and eighteen dollars for exhibition cases; $43.50 for drawers, trays, etc.; $397.91 for glass; $240.77 for hardware, tools, cloth, etc.; $723.76 for glass jars and containers for specimens; $737.65 for lumber; $52.77 for paints, oils, and brushes; $316.70 for office furniture; $42.40 for tin, lead, etc.; $11.88 for rubber goods; $2.85 for traveling expenses, making a total of $3,688.19, and leaving an unexpended balance July 1, 1892, of $2.35.

From the appropriation of $25,000 for furniture and fixtures for the fiscal year ending June 30, 1892, the disbursements are as follows:

For salaries or compensation, $13,885.81; for special or contract services, $87.96; for exhibition cases, with designs and drawings for same, $365; for drawers, trays, and boxes, $543.72; for frames, stands, and miscellaneous woodwork, $169.50; for lumber, paints, oils, glue, and brushes, $2,159.91; for tools, glass, hardware, and interior fittings for cases, $1,407.34; for apparatus, glass jars, vials, etc., $1,191.97; for office and hall furniture and other fixtures, $765; for plumbing, tin and lead, $999.14; for leather belting, rubber tubing for rendering cases moth proof, etc., $122.28; for traveling expenses, $2, making a total of $21,699.63, and leaving a balance of $3,300.37 on hand July 1, 1892, to meet outstanding liabilities.

The following is a detailed list of cases, unit tables, fixtures, etc., made or furnished during the year by persons outside of the Museum:

Two mahogany double-width cases (for lay figures), $350; 2 mahogany unit table cases, $224; 12 mahogany wall cases, $840; 5 mahogany Kensington cases, Gray pattern, $390; 75 pairs mahogany wing frames, $166.50; 200 mahogany case heading frames, $66; 2 insect cabinets, $300; 200 insect boxes, $220; 1 oak desk, $162; 1 oak desk, $145; 1 oak table, $95; 1 small oak desk, $32; 12 pine, half-unit, moth-proof cases, $324; 1 drawing table, $12.50; 1 revolving office chair, $5; 1 umbrella stand, $4.75.

The following is a list of cases, tables, bases, etc., built in the Museum workshops:

Three mahogany American cases; 2 mahogany table-cases, upright; 7 walnut table-cases, double width; 75 moth-proof tables, quarter size; 14 unit tables, half size; 1 pine bookcase, in three sections; 2 pine bookcases, single; 7 pine storage cases, large size; 2 pine unit cases, for poisoning specimens; 1 ash case, special; 1 walnut catalogue-case; 1 pine case for press-copy books.

Cases and tables repaired or remodeled:

One floor case; 2 small Kensington cases; 1 Liverpool case; 1 unit table; 2 unit tables changed into half unit; 2 unit tables, half size, rendered moth proof; 2 unit tables, quarter size, rendered moth proof; wall cases on east and west sides of north hall; 2 pier cases; 14 slide-screen cases; 2 slide-screen cases for costume boxes; 6 floor cases; 1 cherry case for bird group; 1 Kensington case; 2 unit tables, half size; 1 bird case, old style; 1 standard bookcase; 2 catalogue cases; 6 unit tables; 2 unit tables, quarter size; 10 table cases; 2 wall cases; 4 storage cases; 43 cases glazed; 884 cases painted and repolished.

Miscellaneous furniture, fittings, etc., made during the year:

Fifty-two tank boxes; 17 tin boxes for collecting specimens; 60 tin cans for shipping specimens; 721 packing and storage boxes; 740 blocks for the exhibition of specimens; 600 special blocks, index, etc.; 169 bases; 500 brass label holders; 4,000 tin tags; 200 oak tags; 12 copper tanks; 2 lead-lined tanks; 91 label frames; 33 picture frames; 107 unit drawers; 132 unit drawers, half size; 1,049 unit drawers, quarter size; 336 drawers for table cases; 25 drawers for storage, etc.; 381 shelves; 19 doors.

Miscellaneous furniture, fittings, etc., repaired and altered during the year:

Twenty-seven unit boxes repaired; 8 unit boxes, double size, altered; 9 costume boxes altered; 25 tank boxes repaired; 66 tin cans for shipping specimens repaired; 18 packing and storage boxes repaired and altered; 1,440 blocks shellacked and polished; 289 bases repaired, painted, and polished; 52 copper tanks repaired; 644 miscellaneous frames hinged, painted, and glazed; 71 unit drawers repaired; 1,583 drawers fitted; 246 shelves repaired and painted; 21 doors altered; 999 doors repaired, eased, and adjusted.

HEATING AND LIGHTING.

The unexpended balance of the appropriation for heating and lighting and electric and telephonic service for 1891, held to meet unpaid liabilities for that year, was $842.34. Bills have been vouchered and paid from this balance as follows: $46.20 for coal and wood; $74.75 for gas; $200.25 for telephones; $384.95 for electric supplies; $32.75 for electric work; $20 for rental of call boxes; $81.79 for heating supplies, making a total of $840.69, and leaving an unexpended balance July 1, 1892, of $1.65.

From the appropriation of $12,000 for heating and lighting for the fiscal year ending June 30, 1892, the disbursements are as follows:

For salaries or compensation, $5,218.93; for special or contract services, $20; for coal and wood, $3,365.85; gas, $1,360.51; telephones, $622.65; electric work and supplies, $124.53; rental of call boxes, $100; heating repairs, $329; heating supplies, $433.62; making a total of $11,575.09, and leaving an unexpended balance July 1, 1892, of $424.91, to meet outstanding liabilities.

From the appropriation of $5,000 for removing decayed wooden floors in the Museum building, and replacing them with artificial stone pavement, and for the purchase of slate for covering trenches containing heating and electrical apparatus, the expenditures for materials and services to July 1, 1892, are $4,474.64, leaving on that date an unexpended balance of $525.36 on hand to meet outstanding liabilities.

With a view to securing the best pavement possible, as well as for the purpose of obtaining for future guidance a practical knowledge of the merits of the artificial stone flooring made by different bidders, three proposals, which did not vary materially in amount, were accepted. It will require a greater length of time than has yet elapsed to pronounce upon the relative merits of these pavements, but they have already proved themselves far more satisfactory than the wooden floors for which they were substituted, and it is hoped that it will soon be possible to put down the same or some equally durable form of pavement in other parts of the Museum.

From the appropriation of $3,000 for removing the old boilers under the Museum hall in the Smithsonian building, and replacing them with new ones, making necessary alterations and connections of steam-heating apparatus, and covering pipes with fire-proof material, the expenditures are as follows: Alteration of pipes, etc., $121; purchase of two new boilers, $2,769; black pipe, etc., $48.47; making a total expenditure of $2,938.47, and leaving on hand July 1, 1892, an unexpended balance of $61.53 to meet liabilities still outstanding.

The Museum is under obligation to Commodore Melville, U. S. Navy, Chief of the Bureau of Steam Engineering, Navy Department, who, in July, 1891, at the request of the Acting Secretary, appointed a board of engineer officers to prepare specifications and examine bids for the new steam-heating apparatus. The Museum was thus enabled to profit by the skill and experience of Passed Assistant Engineer Baird and Assistant Engineer Leopold, the officers designated to serve on this board. The practical working of the steam-heating apparatus has since demonstrated the wisdom of the board in the preparation of the test questions and specifications submitted to the bidders, and of the

Museum in its final approval of the proposal of the firm to which the work of putting in the new heating apparatus was intrusted.

In addition to the work mentioned in the detailed list, much has been accomplished in the way of general repairs. The carpenter's shop has been extended to make room for two lathes; the storage shed south of the Smithsonian building has been enlarged and the roof tinned; the old paint shop has been reconstructed for use by the special employés detailed for service in connection with the World's Columbian Exposition; steam pipes have been furnished with casing; the old and worn-out fixtures connected with the plumbing of the Smithsonian building have been removed and replaced with new; much necessary repairing has been done to the roofs of both buildings; skylights have been repaired, painted, and glazed; windows have been glazed, painted, and furnished with weather strips; the walls in both buildings have been, to a considerable extent, painted and calcimined, and necessary repairs in general have been made within the means available for this purpose.

By the laying of the asphalt walk on the west side of the Museum, and the consequent raising of the grade in that locality, it was found that the surface water, being turned toward the wall of the building and having no way of escape, frequently collected there to the depth of several inches. Permission was accordingly asked of Col. Ernst, U. S. Army, the Superintendent of Public Buildings and Grounds, to provide for the drainage of this area by the laying of a small sewer to be connected with the large one from the Smithsonian building. The required permit having been issued, the work was done by the Museum force, with materials already available for this purpose.

The buffaloes were removed from the shed south of the Smithsonian building to their new quarters in the Zoölogical Park on the 20th of July, 1891. The building thus vacated was immediately renovated and remodeled for the use of the painters.

The number of requests for the use of the lecture hall by the scientific societies of Washington and the country has not varied materially, the average being about two a month. In some parts of the year, however, the hall is required in this way much more frequently, so that its proper preparation as a room of public assembly becomes an item of considerable importance in connection with the work of the Museum force. The Geographic Society used the room for lectures on five different dates in April, 1892, and in this month, as usual, the annual session of the National Academy was held here for four days, April 19 to 22. At the time of the annual sessions of the various scientific associations of the country, which are often held in the hall of the Museum, it generally becomes necessary, as in the case of the Academy, to prepare and set apart some of the smaller rooms of the building also for the meetings of the committees, a courtesy which is always cheerfully accorded. In addition to these meetings, held in the lecture hall of the Museum. the National Art Association was given permission to use the room in the Smithsonian building, known as the chapel, for an art exhibition during the two weeks beginning May 16, 1892.

It should also be mentioned that various scientific and educational associations avail themselves more and more frequently of the privilege of using the oxyhydrogen lantern belonging to the Museum, for the purpose of illustrating their lectures, which, if not given in the lecture hall, are, as a rule, held at the Columbian University or the Cosmos Club. The lantern is always used under the direction of a skilled operrator connected with the Museum, and, except on occasions for which the use of the lecture hall has been granted by the Regents of the Institution for the Washington meetings of national scientific and educational societies, the expenses incurred for gas, etc., are paid by the society under the direction of which the lecture is given. Among the bodies which have availed themselves of the use of the lantern during this year are the Association of Agricultural Colleges, the Association of Agricultural Chemists, the American Association for the Advancement of Science, the Geological Society of America, the International Geological Congress, the Philosophical Society, the Biological Society, the American Folk-Lore Society, the Cosmos Club, and the Corcoran School of Art.

In compliance with the request of the Department of State, and in accordance with the act of Congress making an appropriation for the purpose, preparations were begun in June, 1892, for an exhibit by the National Museum at the Columbian Historical Exposition, to be held in Madrid, in commemoration of the four hundredth anniversary of the discovery of America.

Preparations for the exhibit of the Museum at the World's Columbian Exposition, commenced last year, have been prosecuted vigorously. As the act of Congress making the appropriation for this exhibit provides for no clerical service, the work of this nature required for the Exposition has been performed by the Museum force, often, of course, at the expense of service beyond the regular departmental hours. While the necessity for extra work is always cheerfully complied with, it is but proper to put on record the fact that there exists a gradually increasing need for a permanent addition to the clerical force.

CORRESPONDENCE AND REPORTS.

The work of this office continues under the direction of Mr. R. I. Geare. The force of assistants in July, 1891, consisted of 2 stenographers, 2 typewriters, 2 indexers, 1 accession clerk, 1 copyist, and 1 messenger. During the year the work increased considerably, and before the close of the year it had been found necessary to obtain the services of an additional clerk. In May, 1892, the distribution of Museum publications was added to the work of the office, and in the months of May and June there were partially distributed Dr. W. L. Abbott's Catalogue of Ethnological Collections in the U. S. National Museum from Kilima-njaro, East Africa (published in the Report of the National Museum for 1891), and a paper by Dr. G. Brown Goode, entitled Museums of the Future (published in the Report of the National Museum for 1890). During the year the routine work connected with the distribution of specimens has also been attended to in this office. The correspondence of the Museum (including the acknowledgment of gifts, loans, and exchanges, the preparation of reports upon material sent for examination, and replies to requests for technical information of all kinds), and the preparation, editing, and proof-reading of the Annual Report of the Museum, constitute the principal work of the office.

The routine work performed in the case of each letter received is as follows: The date of its receipt at the Museum is stamped upon it, after which the proper reference is indorsed upon it.* It is then charged to the person to whom it is referred, and inclosed in a wrapper, on which is written the name and address of the writer, the subject of the inquiry, and the name of the person to whom it is referred. On its return from the referee a reply is prepared, which, with the original letter, is transmitted to the Secretary, Assistant Secretary, or Curator-in-charge, for signature. It is then detached, marked for filing, and a label is attached giving the name and address of the writer, the subject, and date of letter. The letters written are copied in the current number of the appropriate series of letter-books. All letters written are indexed in the letter-books, and also on cards prepared for the purpose. These cards are filed alphabetically, and thus, at a glance, the amount of correspondence with any person, including the date of each letter, can be ascertained. A cross-reference is also prepared under every name mentioned in each letter written, and filed alphabetically. By this means a clew is often furnished to correspondence which it would otherwise be difficult to find.

A record is kept, in card-catalogue form, of all offers of specimens which are not at the time accepted, whether offered as gifts, loans, in exchange, or for sale. The possibility of bringing together in a moment all offers relating to material in a given department of the Museum, has frequently proved very useful, and has saved many hours' work in examining the letter-files.

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*A large proportion of the letters does not require reference, in which case the intermediate steps of the routine are omitted.

PREPARATION OF LABELS.

During the year, 1,986 forms of labels were printed, as shown by the following table, 24 copies of each form being printed:

Department.	Number of forms.
Ethnology	1,578
Minerals	229
Geology	116
Transportation and engineering	32
Naval architecture	31
Total	1,986

BUILDINGS AND LABOR—POLICE AND PUBLIC COMFORT.

The report submitted by Mr. Henry Horan, superintendent of buildings, shows that the force of laborers and mechanics has been busily employed under his supervision, assisted by Mr. Charles A. Steuart. The following abstracts from his report indicate some of the principal items of work the force has accomplished:

1891.

July.—The buffaloes were removed from their quarters south of the Smithsonian Institution to the Zoölogical Park, and the shed thus vacated was remodeled for use as a paint shop. The Jackson sarcophagus was removed from the west hall of the Museum, and placed on the parking north of the building.

August.—The animal pens south of the Smithsonian building were removed. The Museum was opened to visitors on the evening of the 21st, and also of the 28th, on which occasions it was lighted by electricity.

September.—The American Pomological Association held a fruit exhibition in the northeast court from the 18th to the 25th, inclusive. The Japanese house, which has been in storage for some months, was set up in the west hall.

October.—The work of reconstructing the wall-cases on the west side of the north hall was completed. The remainder of the living animals were removed to the Zoölogical Park on the 24th.

November.—The laborers were employed in removing the exhibition cases preparatory to the work of tearing up the floors in the west-south and north-west ranges, for the purpose of laying granolithic pavements. Two heavy slabs of granite and sandstone were fastened to the wall in the west-south range. The work of putting in place the new boilers for the Smithsonian building was commenced on the 23d.

December.—The west end of the Smithsonian building was kalsomined and painted. The cases were removed from the lecture hall, and the room was prepared for the meetings of the American Forestry Association, the American Historical Association, and the American Geographic Association. Granolithic pavements were laid in the tank room, the photographic laboratory, and the north-east court, involving a large amount of work by the laborers in removing cases and cleaning.

1892.

January.—Both buildings were suitably draped in respect to the memory of Gen. M. C. Meigs, a Regent of the Smithsonian Institution, who died January 2. The work of preparation of floors, preliminary to the laying of new pavements by the contractors, was continued during January and February.

February.—Shelves were placed at the west entrance, in order to provide storage room for the property clerk. The wall-case on the south side of the north hall was altered.

March.—A large number of exhibition cases were cleaned, the locks overhauled, and the doors eased. The preparation of the lecture-hall for meetings and lectures required the attention of the laborers several times during the month. It was found that the weight of the exhibition cases rendered the bird gallery in the Smithsonian building unsafe, and some of the cases were accordingly removed.

April.—An electric light was hung at the east entrance of the Museum. Skilled laborers were engaged in repairing the tiling around the building. Repairs were made in the chapel of the Smithsonian building.

May.—The boiler room in the Smithsonian building was thoroughly cleaned and whitewashed, and new window frames were placed in the coral hall. The chapel was prepared for an exhibit by the National Art Association. An electric alarm was placed in the Joseph Francis case, for the purpose of protecting the collection. Sewer traps were placed at the foot of the steps at the northwest entrance of the Museum and in front of the door to the World's Fair carpenter-shop, the work being done by Museum laborers. An addition was made to the south end of the Museum carpenter-shop, to provide room for two lathes.

June.—A number of exhibition cases were brought from storage in the Armory building and prepared for shipment to the Madrid Exposition. The large lathe was removed from the engine room to the carpenter shop. The shed at the west end of the Smithsonian building was extended to provide room for the storage of cases, etc. The work on the new return pipes of the Smithsonian building was completed on the 17th instant, so far as it was possible to carry them this fiscal year. A concrete walk was laid in the area at the south door of the Smithsonian, the work being done by laborers from the Museum force. Extensive repairs were made in the public-comfort rooms.

THE WORK OF THE MUSEUM PREPARATORS.

TAXIDERMISTS.

The force of taxidermists, under the charge of Mr. William Palmer, has been engaged, the greater part of the time, in the preparation of an exhibit for the World's Columbian Exposition. The entire exhibition series of mammals has been examined and cleaned, and a number of mounted specimens have been repaired and placed upon new stands. The skins in pickle have been overhauled. The total number of skins received from all sources during the year is 492. Of this number 368 have been worked up. The total number of skins on hand at the end of the year is 452. For the World's Fair exhibit, 181 mammals have been mounted and finished, including 6 Rocky Mountain sheep, 5 Newfoundland caribou, 3 Alaskan caribou, 3 Arizona deer, 4 armadillos, 5 badgers, 8 Californian sea lions, a male walrus, from Walrus Island, Bering Sea, and an African crocodile. A series of experiments have been successfully made with a view to preparing a composition for making casts of reptiles. Experiments, with good results, have also been made in preserving leaves and plants for use as accessories in groups of animals.

OSTEOLOGICAL PREPARATOR.

The greater part of the time of Mr. F. A. Lucas, the osteological preparator, has been devoted to matters other than those pertaining directly to his department. Important work has, however, been accomplished in the preparation of skulls and skeletons for the study series. Several weeks were spent in the preparation of the skeleton of a young sperm whale. A summary of the work accomplished is given in the following table:

	Mammals.	Birds.	Reptiles.	Fishes.	Total.
Received in the flesh:					
Entire skeletons	7	17	10	52	86
Skulls					
Incomplete skeletons				1	1
Cleaned:					
Entire skeletons	8	14	31	48	101
Skulls	376	9	3		388
Incomplete skeletons	14	13	1		28
Mounted:					
Skeletons			2	11	13
Incomplete skeletons				1	1
Total	405	53	47	113	618

In addition, 86 specimens of vertebrate fossils were cleaned, 29 molds and 25 casts of invertebrates were made, and 6 anatomical models were mounted.

PHOTOGRAPHER.

Mr. T. W. Smillie, the photographer, reports that he has made 295 negatives during the year, as follows:

Ethnology	45
Mammals	46
Geology	54
Prehistoric anthropology	20
Miscellaneous	130

There have also been made 1,656 silver prints, as shown by the following table:

Ethnology	770
Mammals	64
Geology	333
Prehistoric anthropology	29
Miscellaneous	460

In addition, 181 cyanotypes and 36 lantern slides were made. For the U. S. Fish Commission there were prepared 719 silver prints, 389 cyanotypes, and 35 negatives. For this work the Commission furnishes the necessary material and an assistant to aid the photographer.

COLORIST.

Mr. A. Zeno Shindler has been engaged in painting life-size casts for the Department of Ethnology, including among others the figure of an Una Indian, a group of five Kiowa children at play, an Eskimo woman at play, an Eskimo woman and child, Sitting Bull, and a Labrador woman and child. Mr. Shindler has also continued the work of painting in oil representations of the various races of man, and has made a copy from a photograph of a painting of Pocahontas, dated 1616.

G.—ACCESSIONS.

The number of accessions received during the year is 1,357* (accessions Nos. 24528 to 25884, inclusive). These accessions embraced 228,249† specimens, giving an average of about 168 specimens to each accession. This increase over the number of accessions received last year, as shown in the foot-note, is the more conspicuous, as no effort has been made to invite contributions on account of lack of space for exhibition or storage. A large proportion of the specimens received will, for this reason, have to remain in the boxes in which they were shipped to the Museum.

A tabulated statement, showing the number of accessions to the Museum annually since 1881 (the first year of occupancy of the Museum building) is here presented:

Year.	Accession numbers (inclusive).	Number of accessions during the year.
1881	9890—11000	1111
1882	11001—12500	1500
1883	12501—13900	1400
1884	13901—15550	1650
1885 (January to June)	15551—16208	658
1886	16209—17704	1496
1887	17705—19350	1646
1888	19351—20831	1481
1889	20832—22178	1347
1890	22179—23340	1162
1891	23341—24527	1187
1892	24528—25884	1357

GEOGRAPHICAL REVIEW OF THE MORE IMPORTANT ACCESSIONS.

AFRICA.

CENTRAL AFRICA.

From the Department of State, through Hon. James G. Blaine, Secretary, was received a collection of butterflies; a specimen of *Selaginella;* the pappus of a seed, collected by Mr. J. H. Camp in Central Africa, and four photographs of natives of West Africa.

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* An increase of 170 over the number of accessions received last year.

† An increase of 94,639 over the number of specimens received last year.

EAST AFRICA.

From Dr. Cyrus Adler, National Museum, were received manuscripts, parts of costumes, weapons, and instruments from Egypt. Dr. Adler also deposited a Soudanese girdle, worn by women, and a camel driver's coat from the Upper Nile region.

Mr. William Astor Chanler, of New York City, presented two mounted giraffe heads (male and female).

Mr. C. B. Cory, Boston, Mass., transmitted in exchange a skin of crocodile bird (*Pluranius ægyptiacus*).

From Dr. James Grant-Bey, Cairo, were received two Arab glass-lamps.

NORTH AFRICA.

Mr. C. F. Ancey, Boghari, Algeria, transmitted in exchange several specimens of rare African shells.

From the Royal Zoölogical Museum, Florence, Italy, through Prof. Henry Giglioli, director, were received in exchange archæological objects from northern Africa.

SOUTH AFRICA.

Mr. A. L. Babcock, Sherborn, Mass., transmitted, in exchange, three species of South African coleoptera.

WEST AFRICA.

Mr. R. R. Gurley, U. S. Fish Commission, presented a hammock.

Seven specimens, representing four species of birds' skins from Angola, were collected for the National Museum and transmitted by Messrs. W. H. and A. H. Brown.

From Rev. A. C. Good, American mission, Gaboon, was obtained by purchase a collection of ethnological objects relating to the life and manners of the Fang tribe, and a number of musical instruments.

AMERICA.

NORTH AMERICA.

From the Department of Agriculture, through Prof. C. V. Riley, entomologist, were received species of coleoptera new to the collection; also specimens of North American coleoptera, collected by D. W. Coquillet.

From Prof. L. Bruner, Lincoln, Nebr., through Prof. Riley, were received specimens of coleoptera and four types of a new orthoptera.

From Dr. William Eichhoff, Strasburg, Germany, were received in exchange, typical specimens representing 100 species of North American and exotic Scolytidæ, new to the collection.

From the U. S. Fish Commission, through Col. McDonald, commissioner, was received a collection of crustaceans obtained by the Fish

Commission vessels on the Atlantic coast, and also crustaceans chiefly from the North Pacific Ocean, collected during the cruises of the steamer *Albatross* for the past four or five years.

From Mr. William J. Fox, Academy of Natural Sciences, Philadelphia, through Prof. Riley, were received in exchange specimens of North American aculeate hymenoptera, most of which are new to the collection.

BRITISH AMERICA.

British Columbia.—From Mr. Ashdown Green, Victoria, was received a fine specimen of *Chirolophus polyactocephalus.*

From Mr. R. MacFarlane, Cumberland House, Saskatchewan, were received birds' nests, skins and eggs, collection of fossil resin, and skin of a marmot (*Arctomys monax*).

From Dr. Karl Rominger, Ann Arbor, Mich., were received 145 specimens of Middle Cambrian fossils from Mount Stephen.

Mr. Frank Russell, Iowa City, Iowa, presented eight fossil shells.

Mr. Walter D. Wilcox, New Haven, Conn., presented valuable specimens of Middle Cambrian carboniferous fossils from Mount Stephen.

Labrador.—From the Department of Agriculture were received 3 gray seals.

Newfoundland.—From Col. Cecil Clay, Department of Justice, were obtained by purchase 5 specimens of woodland caribou.

CENTRAL AMERICA.

British Honduras.—From the Royal Zoölogical Museum, Florence, Italy, through Prof. Henry Giglioli, director, were received archæological objects from British Honduras.

Costa Rica.—From the National Museum, San José, were received birds' skins, and, through Mr. George K. Cherrie, were received type specimens of *Mionectes semischistaceus*, sp. nov., and *Ornithion pusillum subflavum.*

Mr. Gustave Michaud, San José, through Prof. C. V. Riley, United States entomologist, Department of Agriculture, transmitted specimens representing various orders of insects.

Yucatan.—Capt. Charles E. Bendire, U. S. Army, honorary curator of birds' eggs, National Museum, presented a set of eggs of *Tantalus loculator.*

From the U. S. Fish Commission, through Col. McDonald, commissioner, were received shells and alcoholic specimens of lizards from Cozumel Island, off the coast of Yucatan, collected in 1885.

MEXICO.

Capt. John G. Bourke, U. S. Army, presented a collection of Guadalajara pottery, and deposited soles of the "guarachi," or sandals, used by the Mexican foot-soldiers along the Rio Grande; throwing-stick and bird-spear, and specimens of folk-medicine of the Lower Grande Valley.

Mr. Britton Davis, Corralitos, Chihuahua, transmitted a specimen of the rare snake, *Heterodon kennerlyi.*

Prof. A. Dugès, Guanajuato, sent the skin of an orange-crowned warbler (*Helminthophila celata*).

From Dr. A. E. Foote, of Philadelphia, Pa., were obtained by purchase 2 specimens of calcite from Guanajuato.

Mr. W. J. McGee, U. S. Geological Survey, transmitted silver ores.

From Dr. C. H. White, U. S. Navy, were received miscellaneous insects from Acapulco.

Mr. P. L. Jouy collected for the Museum in northern Mexico very interesting and valuable specimens. A full report upon these will be found in the accession list, Section V.

UNITED STATES.

Alabama.—Messrs. Clarence and Samuel E. Varee, Brownsville, presented a specimen of living alder-blight, *Pemphigus tesselatus* Fitch.

Alaska.—Dr. Frank Baker, acting manager of the National Zoölogical Park, transmitted to the Museum an Arctic fox and a specimen of aguti, a day old. The fox was obtained from St. George Island by Dr. C. Hart Merriam, Department of Agriculture.

From the U. S. Fish Commission, through Col. McDonald, commissioner, were received birds' skins and eggs, collected by C. H. Townsend, and plants obtained during the cruise of the steamer *Albatross* in 1889 and 1890.

Maj. J. W. Powell, Director of the U. S. Geological Survey. transferred to the Museum two pairs of snow-shoes, collected by Mr. I. C. Russell, from Charley's Village, Yukon River.

Mr. Chase Littlejohn, Redwood City, Cal., presented eggs of the rare Steller's duck (*Eniconetta stelleri*), from the mouth of the Yukon River.

Mr. I. C. Russell, U. S. Geological Survey, transmitted a collection of Eskimo ivory carvings, dishes, and other ethnological objects from the Upper Yukon River.

Arizona.—From the Department of Agriculture was received a highly interesting collection of fresh-water shells from various localities in Arizona, principally in the vicinity of Death Valley.

From Mr. George A. Allen, U. S. Indian agent, Colorado River Agency, Parker, were received specimens of *Pepsis formosa* Say and *Sphærophthalma creusa* Cress; skins of two rare bats, *Macrotus californicus* and *Molossus californicus* Merriam.

From Dr. A. E. Foote, Philadelphia, Pa., were obtained by purchase specimens of meteoric iron and the same material altered to limonite, from Cañon Diablo.

Mr. P. L. Jouy collected for the National Museum some valuable reptiles, a full report upon which will be found in the accession list, Section v.

Mr. George P. Merrill, U. S. National Museum, presented specimens of *Asida sordida*, Lec., the only insect found on the plains about Cañon Diablo.

Mr. Cosmos Mindeleff, U. S. Bureau of Ethnology, presented specimens of calcite pseudomorph after glauberite.

Dr. Timothy E. Wilcox, U. S. Army, transmitted a valuable and interesting collection of reptiles and a living specimen of horned toad.

Arkansas.—Dr. W. P. Jenney, U. S. Geological Survey, transmitted two specimens of cadmaniferous smithsonite from Morning Star Mine, Marion County, and specimens of ores.

California.—From the Department of Agriculture was received a collection of fresh-water shells from Death Valley.

From the Department of Agriculture, through Prof. C. V. Riley, entomologist, were received specimens of Californian orthoptera, collected by D. W. Coquillet; specimens representing species of rare coleoptera, collected by D. W. Coquillet in San Diego and Los Angeles counties; specimens of Californian coleoptera, lepidoptera, hymenoptera, hemoptera, and diptera, also collected by Mr. Coquillet, and specimens of insects collected by Mr. A. Koebele, of the Death Valley Expedition.

Mr. L. Belding, Stockton, presented birds' skins, and the head, wing, and foot of a blue goose, *Chen cærulescens*.

The Hon. W. W. Bowers, House of Representatives, presented a block of pure pig-iron, and a specimen of tin ore from the Temescal Tin Mine, South Riverside, San Bernardino County.

From the Fish Commission, through Col. McDonald, commissioner, was transmitted the skin of a coast fox, *Orocyon virginianus littoralis* from Santa Rosa Island, collected by Mr. Charles Townsend, of the Fish Commission steamer *Albatross*.

Mr. L. L. Frost, Susanville, presented a collection of archæological objects, and a polished stone object supposed to be a charm-stone.

Maj. J. W. Powell, director of the U. S. Geological Survey, transferred to the Museum 34 specimens of radiated brown tourmaline from Colfax, Nevada County, collected by Mr. W. Lindgren.

Dr. W. P. Jenney, U. S. Geological Survey, presented a specimen of rubellite.

Miss Annie B. Picher, Pasadena, presented photographs of Padre Serra, a Mexican drawn-work maker; Father Serra's stirrup (Indian wood-carving), and a piece of drawn-work showing the "Little Jesus" stitch.

Lieut. Charles Pond, U. S. Navy, Mare Island, sent a sphinx-moth (*Smerinthus opthalmicus* Bd.).

Colorado.—From Mr. T. Charlton, Denver, were received three teeth of extinct llama (*Auchenia hesterna*).

From Mr. Thomas H. Jackson, West Chester, Pa., was obtained, by purchase, a set of eggs of the white-tailed ptarmigan (*Lagopus leucurus*).

Mr. W. W. Jones, Silver Cliff, presented specimens of cerussite and nadorite with cerussite.

From Mr. S. Ward Loper, U. S. Geological Survey, were received specimens of banded jasper from Cañon City.

Dr. William L. Ralph, Utica, N. Y., presented two skins of saw-whet owl (*Nyctala acadica*), a flammulated screech owl (*Megascops flammeolus*), and a woodpecker (*Dryobates villosus hyloscopus*).

Maj. J. W. Powell, director of the U. S. Geological Survey, transferred to the Museum minerals and rock showing slickensides, collected by Prof. S. L. Penfield.

Connecticut.—Mr. S. Ward Loper, U. S. Geological Survey, presented a specimen of augite rock from East Rock, and sent in exchange two slabs of shale with rain-prints from Durham.

From Prof. William North Rice, Wesleyan University, Middletown, were received rocks and ores in exchange.

The Singer Manufacturing Company, Hartford, transmitted an old-style Singer sewing machine, and one of the latest style of manufacture.

District of Columbia.—Mrs. S. S. Cox deposited the memorial vase presented to her by the members of the Life-Saving Service of the United States in commemoration of the services of the late S. S. Cox.

From Mr. H. W. Henshaw, Bureau of Ethnology, was received a fine set of mounted herbarium plants, representing the fauna *Quercus*, *Aster*, and *Solidago*, forming a very complete and valuable addition to the collection.

From Gen. M. C. Meigs, through his executors, Montgomery Meigs and Mary M. Taylor, were received medals, bronzes, and other historical relics. A full description will be found in the accession list, Section V. A revolving rifle of very early pattern, invented about 1835, made at Rochester, by Billinghurst, seven colored sketches, and twenty-three pencil sketches had been previously transmitted by General Meigs.

Dr. R. W. Shufeldt, U. S. Army, Takoma Park, transmitted a model of a fossil bird, *Archæopteryx macrura*, from Solenhofen, Bavaria.

Mr. Charles W. Richmond, of the Department of Agriculture, transmitted 3,000 birds' skins.

Florida.—The Florida Phosphate Company, Phosphoria, transmitted samples of phosphate rock from various counties.

From Dr. E. M. Hale, Chicago, Ill, was received a snake, *Osceola elapsoidea*.

Mr. Alexander Lynch, President of the Bloomfield Kaolin and Phosphate Works, Gainesville, sent specimens of kaolin.

From Dr. William L. Ralph, Utica, N. Y., was received a mounted wolf, *Canis lepus griseoalbus*.

From Mr. De Witt Webb, St. Augustine, were received archæological objects from shell-mounds.

Mr. George Webster, Lake Helen, transmitted specimens of land and fresh-water shells.

Georgia.—Mr. J. C. Hart, Union Point, through Mr. J. L. Black, Blacksburg, S. C., transmitted specimens of magnetic ores from the line of Green County.

From the U. S. Geological Survey, through Maj. J. W. Powell, director, were received specimens of minerals.

Idaho.—Maj. J. W. Powell, director of the U. S. Geological Survey, transferred to the National Museum minerals collected by Dr. W. H. Melville in Mullan.

Illinois.—Mr. O. Chanute, Chicago, presented a collection of antique patterns of rail-sections, maps, and other objects.

Indian Territory.—Mr. W. H. Holmes, U. S. Geological Survey, transmitted 3 rude implements of novaculite from an ancient Indian quarry.

Indiana.—Mr. Frederick C. Test, U. S. National Museum, presented reptiles and batrachians.

From Mr. Benjamin Vail, Washington, D. C., was received a trilobite found 3 miles west of Aurora.

Kansas.—Maj. J. W. Powell, director of the U. S. Geological Survey, transferred to the Museum specimens of minerals from Galena, collected by Dr. W. P. Jenney.

Kentucky.—From the U. S. Geological Survey, through Maj. J. W. Powell, director, was received a specimen of chalcedony.

Louisiana.—Mr. T. Wayland Vaughn, Mt. Lebanon, Bienville Parish, presented fresh-water shells representing 11 species.

Maine.—From the Forest and Stream Publishing Company, New York City, was received the head and tail of an Atlantic salmon (*Salmo salar*) from the mouth of the Cabbassacontic River, sent by Mr. John T. Richards, Gardiner, Me.

From Dr. A. C. Hamlin, Bangor, were received in exchange 10 cut specimens of tourmaline and 19 samples of red and green tourmaline.

Dr. W. P. Jenney, U. S. Geological Survey, transmitted a specimen of kyanite from Windham.

Maryland.—From Mr. James E. Benedict, National Museum, were received specimens of *Gelasimus minax*.

From the Life-Saving Service, Treasury Department, was received a skeleton of *Physeter macrocephalus* juv., from Green Run Inlet Life-Saving Station, collected by Capt. J. J. Dunton, keeper; also a rare specimen of fossil crab, sea-horses and specimens of quartz, obtained in the same manner.

From Mr. L. G. Eakins, of the Geological Survey, was received a specimen of native gold in quartz from Potomac Mine, Montgomery.

Mr. C. W. Richmond transmitted a marsh hawk (*Circus hudsonius*), and a long-eared owl (*Asio wilsonianus*).

Massachusetts.—Prof. William North Rice, Wesleyan University, Middletown, Conn., transmitted rock and ores in exchange.

Michigan.—Mrs. M. L. Narrin, Goodrich, transmitted specimens of serpentine quartzite.

Mr. George W. Webster, Lake Helen, Fla., sent 9 species of land and fresh-water shells.

Minnesota.—From the Bureau of Ethnology, through Maj. J. W. Powell, director, was received a collection of birch-bark scrolls and mnemonic songs, obtained by Dr. W. J. Hoffman during the years 1887-'88, '89 and '90, relating to the ritual of the Society of Shamans, usually designated the "Grand Medicine Society."

Missouri.—From the U. S. Geological Survey, through Maj. J. W. Powell, director, were received minerals collected by Dr. W. P. Jenney, in Aurora, Joplin and Sherwood.

Montana.—From Prof. B. W. Evermann, of the U. S. Fish Commission, were received two specimens of *Anabrus simplex* Hald., collected at Missoula.

From the Fish Commission, through Col. Marshall McDonald, commissioner, was received a collection of reptiles and batrachians collected by the Commission in 1891, and specimens of fishes, including a new species, collected during the summer of 1891, by a Fish Commission party under the direction of Prof. B. W. Evermann.

Mr. C. H. Hand, of Butte, transmitted through Messrs. Packard and Melville, of the U. S. Geological Survey, a specimen of granite with native copper oxide, from Rice's Addition Mine.

From Prof. A. D. Meeds, University of Minnesota, Minneapolis, was received an exceedingly fine slab of stone from the Fort Union Group of southern Montana, bearing the impression of eight fossil leaves, among them a *Populus*, new to science.

Mr. R. S. Williams, Great Falls, transmitted the nest and four eggs of *Geothlypis macgillivrayi*, and nest and three eggs of *Empidonax flaviventris*, both of which are rare and valuable species.

Nevada.—From Mr. Walter F. Webb, Geneva, N. Y., were received 15 eggs (5 sets) of *Larus Californicus* from Pyramid Lake.

Nebraska.—Prof. Robert Hay, of Kansas, sent a block of standstone from the sandstone dyke in northeast Nebraska.

Maj. Powell, director of the U. S. Geological Survey, transferred to the Museum, the tooth of a specimen of *Petalodus destructor*, a carboniferous selachian, collected by Mr. David A. Harrah.

New Hampshire.—From Mr. H. P. Sharpless, Boston, Mass., were received two specimens of columbite from Wakefield.

New Mexico.—Mr. George H. Thwaites, of Socorro, presented three fine specimens of lepidodendron.

New Jersey.—From Mr. W. G. Binney, of Burlington, were received photographs of the teeth of mollusks, the original drawings of shells, slugs, and cuts of shells used in various publications on land-shells. These constitute a valuable donation.

New York.—From Mr. Park Benjamin, New York City, was received the original application of Jesse Ramsden, dated December 2, 1775, for a patent in England, written and signed by himself, for an astronomical equatorial instrument.

Mr. E. H. Chapin, Baltimore, Md., transmitted a trilobite, *Phacops rana*, from the Hamilton group.

From Mr. F. L. Church, Shusha, was obtained, by purchase, a six-legged frog.

From Prof. Thomas Egleston, of the School of Mines, Columbia College, New York City, were received in exchange minerals from various localities.

From Messrs. Otis and Gorsline, Rochester, through Prof. H. L. Fairchild, were received specimens of well-drillings from a deep well at Rochester.

Dr. William L. Ralph, Utica, presented a magnificent collection of birds' eggs, containing 1,630 specimens, representing 444 sets and 194 species, several of which are new to the Museum, and also 100 birds' nests.

Prof. William North Rice, Wesleyan University, Middletown, Conn., transmitted rocks and ores in exchange.

Mr. C. D. Walcott, U. S. Geological Survey, presented four specimens of calcite from Smith's Basin, Washington County.

From the Williamsburgh Scientific Society, Brooklyn, was received fossil rock found in the Catskill Mountains, at High Falls, Greene County.

North Carolina.—From H. A. Lindsey, Asheville, was obtained by purchase a specimen of fergusonite from Madison County.

The Morganton Land Improvement Company, Morganton, transmitted a specimen of almandite and specimens of corundum altering to damourite from Burke County, and corundum from Yancey, collected by Mr. W. S. Yeates, of the National Museum.

From Dr. Hugh M. Smith, U. S. Fish Commission, were received 7 specimens of *Acris gryllus* from Plymouth.

From the U. S. Geological Survey, through Maj. J. W. Powell, director, were received 46 specimens of minerals.

Mr. W. S. Yeates, U. S. National Museum, presented an Indian banner-stone from near Zirconia.

North Dakota.—From Mrs. Mary C. Collins were received cretaceous fossils from the Montana formation.

Oklahoma Territory.—From Rev. T. R. Voth, Darlington, was obtained, by purchase, a tomahawk pipe.

Ohio.—Mr. William H. McGinniss, Youngstown, presented 116 crystals of selenite from Ellsworth, Mahoning County.

Oregon.—From Dr. C. T. Cooke were received 2 skins of Steller's jay (*Cyanocitta stelleri*), and a handsome nest of the same species, new to the collection.

Pennsylvania.—From Mr. R. D. Lacoe, of Pittston, was received the first installment of his collection of fossil plants (known as the Lacoe collection), presented by him to the National Museum.

The Pennsylvania Railroad Company, through Mr. Joseph T. Richards, assistant chief engineer, transmitted a plaster cast of a bronze table for the Bordentown monument, to mark the first piece of track laid in the State of New Jersey, and also to commemorate the sixtieth anniversary of the first movement by steam in New Jersey.

From Mr. Edward S. Thompson, Thompsontown, were received 408 archæological objects found along the Juniata River between Thompsontown and Port Royal.

Titus Ulke, Washington, D. C., presented rare specimens of coleoptera collected at Blue Ridge Summit.

From the U. S. Geological Survey, through Maj. J. W. Powell, Director, was received a specimen of wavellite from Steamboat Springs, Chester County.

Rhode Island.—From Mr. George A. Lewis, Wickford, was received an American eider (*Somateria dresseri*) in the flesh.

South Carolina.—From the Wagner Free Institute of Science, Philadelphia, through Mr. Joseph Willcox, was received a collection of pliocene fossils from the Waccamaw River.

South Dakota.—Mr. John H. Ainley, Rapid City, transmitted specimen of hornblendic schist, showing free gold, from the Cross Mine, Pennington County.

From Mr. J. H. Caton, Rosebud Agency, was received a fossil turtle, *Stylemys nebrascensis*, from Bad Lands, and impure opal from the same locality.

From the Museum of Comparative Zoölogy, Cambridge, Mass., were received in exchange two lizards, collected by Prof. S. Garman.

Texas.—From Prof. H. P. Attwater, Rockport, was received a set of eggs of *Otocoris alpestris giraudi* (new to the collection) and eggs of *Cardinalis cardinalis* and *Mimus polyglottus*, selected to show extremes in size and coloration, and forming a very interesting series.

From the Department of Agriculture, through Prof. C. V. Riley, were received 200 specimens of various orders of insects, collected by Mr. C. G. Schaupp.

Mr. L. G. Eakins, U. S. Geological Survey, presented gadolinite from Llano County.

Vermont.—Mr. C. D. Walcott, U. S. Geological Survey, transmitted specimens of contorted slate from Rutland County.

Virginia.—From the Bureau of Ethnology, through Maj. J. W. Powell, Director, was received a collection of archæological objects from a mound in Rockingham County.

Mr. Walter Moreland, Washington, D. C., sent a specimen of *Larimus fasciatus*, rarely found on our Atlantic coast. This is the second specimen so far recorded from Chesapeake Bay.

Washington.—Robert Intram, esq., of Chenoweth, presented a specimen of centiped (*Chomatobius ruber*), a species now occurring in the East, and a specimen of milleped, new to science.

West Virginia.—From Mr. John R. Huddleston, Kanawha Falls, was obtained, by purchase, a double-headed snake.

Wyoming.—From the U. S. Fish Commission, through Col. McDonald, were received 955 specimens of fishes, including *Leuciscus gilli*, a new species, collected during the summer of 1890, by a Fish Commission party, under direction of Prof. B. W. Evermann.

Miscellaneous.—Prof. S. L. Fairfield, New Haven, Conn., presented specimens of minerals from various localities.

Admiral and Mrs. James E. Jouett deposited a dish and ewer of precious metals, presented to Admiral Jouett for services rendered in saving from shipwreck the British steamship *Historian* in the Caribbean Sea in 1885.

Mr. Robert Ridgway, U. S. National Museum, presented birds' skins, consisting of selected specimens, each one remarkable for some more or less marked peculiarity of plumage.

From Dr. Leonhard Stejneger, U. S. National Museum, were received birds' skins, including a series of *Sitta cæsia*, from various localities.

The U. S. Geological Survey, through Maj. J. W. Powell, Director, transferred to the Museum a collection of fossil insects, described and figured by Prof. S. H. Scudder, of the Geological Survey, in volume XIII, Hayden Reports; fossil plants, transmitted by Dr. J. S. Newberry, of Columbia College, to the Survey, and specimens of minerals from various localities.

ISLANDS IN THE ATLANTIC OCEAN.

St. Helena.—From Capt. W. H. Turton, R. E., Brompton Barracks, Chatham, England, were received shells, comprising over 400 species, a contribution of special interest and value.

WEST INDIES.

From Dr. John F. Chittenden, Victoria Institute, Trinidad, through Hon. William Pierce, U. S. Consul, were received specimens of *Achirus lineatus* and *Azevia* n. sp.

Mr. C. W. Cunningham, through Maj. J. W. Powell, Director of the Geological Survey, transmitted samples of crude potroleum.

From Dr. J. F. R. Dufour, Washington, D. C., was received a skin of brown pelican (*Pelecanus fuscus*).

Mr. Frank Everett, Washington, D. C., presented birds' eggs, and deposited a Carib stone hatchet from the island of Navassa.

From Mr. T. H. Morgan, Mawr College, Bryn Mawr, were received crustaceans from near Jamaica.

From the Wagner Free Institute of Science, Philadelphia, were received land-shells.

SOUTH AMERICA.

BRAZIL.

Messrs. Tiffany & Company, New York City, transmitted in exchange a specimen of "Phantom" quartz.

Mr. William Palmer, U. S. National Museum, presented a specimen of Jandaya Parrakeet (*Cornurus jandaya*).

From the Royal Zoölogical Museum, Florence, Italy, through Prof. Henry Giglioli, director, were received in exchange archæological objects from Brazll.

CHILE.

Dr. C. H. White, U. S. Navy, presented specimens of crude nitrate of soda from Iquique.

PERU.

Dr. White, U. S. Navy, transmitted a collection of insects from Payta.

UNITED STATES OF COLOMBIA.

From Mr. M. L. Marks, Washington, D. C., were received 5 gold ornaments obtained from ancient graves.

VENEZUELA.

Mr. R. M. Bartleman, United States legation, Carácas, transmitted photographs of native scenery and other objects relating to Venezuela. He also sent an armadillo (*Tatusia* sp.).

From Mr. C. B. Riker, New York City, were received birds' skins from the Lower Amazon.

ASIA.

CHINA.

From Mr. Romyn Hitchcock were received 6 copies of the "Peking Gazette," the oldest newspaper in the world and now published daily in Peking.

From Dr. J. Neumann, Hoihow, were obtained a collection of cocoanut ware, tools used for carving shells, and other ethnological objects.

INDIA.

Dr. William L. Abbott, Philadelphia, presented a very fine collection of mammal skins, skulls, bones, birds' skins, and a rope made of goat's hair used by the coolies of Kashmir in packing their loads. A full report of this sending will be found in the Accession List in Section v.

From the Calcutta Botanic Garden were received specimens of dried plants.

JAPAN.

From the Science College Museum, Imperial University, Tokio, through Dr. J. Ijima, were received two skins of Japanese ptarmigan (*Lagopus*, species undetermined).

KOREA.

From Mr. P. L. Jouy, U. S. National Museum, was received the skin of a land otter (*Lutronectes* sp.). From Mr. Jouy was also obtained, by purchase, specimens of reptiles from a remote region of Korea.

From the Department of State were received specimens of wool and woolen fabrics, transmitted by Consul-General Samuel Merrill, from Chitteldroog and Davengire Táluks, in the Chitteldroog district, province of Mysore, collected by Mr. L. Ricketts, director of statistics and agriculture in Mysore-Bungalore, with a report on sheep and wool in India furnished by Mr. Merrill; samples of Indian wool, collected by Mr. Merrill and Mr. T. N. Mukharji, assistant curator of the Indian Museum; woolen fabrics contributed by Mr. L. Ricketts, of Mysore-Bungalore; and specimens of Indian wools, woolen yarns and fabrics, transmitted through Mr. Merrill.

ASIATIC RUSSIA.

Lieut. G. B. Harber, U. S. Navy, transmitted articles of fur clothing worn by him while connected with the Jeannette Relief Expedition, made by the Yokuti of northern Siberia.

From the U. S. Treasury Department was received the skin of a female walrus (*Odobænus obesus*), captured in Holy Cross Bay, Siberia, and transmitted by Capt. M. A. Healy, U. S. R. M. steamer *Bear*, through Lieut. D. H. Jarvis, of the same steamer.

From Mr. Romyn Hitchcock, U. S. National Museum, was obtained by purchase a walrus's head and tusks from Anadir Bay.

From the Royal Swedish Academy of Sciences, Stockholm, Sweden, were received, in exchange, 140 species of Siberian phanerogams.

Messrs. Tiffany & Co., New York City, transmitted, in exchange, 3 ornamental stones.

ASIA MINOR.

From Dr. John P. Peters, Philadelphia, was received through Dr. Cyrus Adler, a Turkish baker's tally from Broussa, in Aaia Minor, the ancient capital of Turkey. From Dr. Peters were also received a weaving-loom, card, and shuttle.

ISLANDS IN THE INDIAN OCEAN.

Mr. Hugh Fulton, London, England, sent, in exchange, a specimen of *Voluta aulica* L.

Mr. Isaiah Greegor, Jacksonville, Florida, presented interesting marine shells.

EUROPE.

DENMARK.

From Mr. N. C. Gram, Dyrefjord, Iceland, were received two ladies' side-saddles, one marked 1789 and the other reported to be 250 years old.

From the Icelandic Natural History Society, through Mr. Benjamin Gröndal, president, were received, in exchange, portions of a woman's costume, carved vessels for food, and other ethnological objects from Reykjavik, Iceland.

Dr. D. S. Martin, New York, transmitted two specimens of lignite from Disco Island, Greenland.

Messrs. Wyckoff, Seamans & Benedict, New York City, transmitted a Mallig-Hansen typewriter from Copenhagen.

FRANCE.

From Mr. Henry Balfour, Oxford, England, were received, in exchange, archæological objects.

Mr. George F. Harris, London, England, sent a collection of Eocene fossils, chiefly from the Paris basin.

Miss Katherine Parsons, Washington, D. C., deposited a sedan chair formerly owned by the family of Louis XIV.

From the Royal Zoölogical Museum, Florence, Italy, through Prof. Henry Giglioli, director, were received archæological objects from France.

GERMANY.

From Dr. William Eichhoff, Strasburg, were received in exchange type specimens representing 100 species of Scolytidæ, all new to the collection.

Prof. Dr. A. Nehring, Berlin, transmitted, in exchange, seeds of *Cratopleura helvetica* Nehringi, C. Weber, found in peat at Klingi.

From Prof. A. Streng, Giessen, were received minerals, in exchange.

GREAT BRITAIN.

From Prof. George S. Brady, Sunderland, were received in exchange specimens of British fresh-water Cyclopidæ.

From Messrs. Elkington & Company, London, was received an electrotype reproduction of Tycho-Bache's quadrant.

Mr. A. E. Foote, Philadelphia, transmitted in exchange specimens of anglesite and matlockite from Cromford, Derbyshire.

From Mr. C. D. Walcott, U. S. Geological Survey, were received echinoids, specimens of flint, and the tooth of a shark from the cretaceous chalk of Croydon.

GREECE.

From C. H. Pennypacker, West Chester, Pa., were obtained, by purchase, specimens of adamite and smithsonite.

NORTH HOLLAND.

Mr. Edward Lovett, Croydon, England, tramsmitted a curious old flint.

ITALY.

From the Royal Zoölogical Museum, Florence, Italy, through Prof. Henry Giglioli, director, were received archæological objects and sponges.

Dr. G. Brown Goode, Assistant Secretary, National Museum, collected for the Museum twenty-three pieces of Savony faience. The potteries have been discontinued for nearly two centuries, and the pieces are principally of the 14th and 15th centuries, most of them being druggist's vessels of a highly ornate character.

From the National Museum of Anthropology, Florence, through Dr. Paolo Mantegazza, director, were received archæological objects.

RUSSIA.

Mr. Charles de Struve, envoy extraordinary and minister plenipotentiary, Russian legation, presented thirty-nine sheets of portraits of Russians.

Lieut. George F. Emmons, U. S. Navy, Sitka, Alaska, transmitted a fish-knife obtained from a native Russian woman. The knife was made in Siberia, and is a relic of ancient Russia.

Mr. George F. Kunz, Hoboken, N. J., transmitted through Consul-General J. M. Crawford, St. Petersburg, a collection of castings of figures, set of Russian weights, samples of ores, and specimens of sand from which the castings are made.

SPAIN.

From Hon. R. W. Turner, U. S. consul, was obtained a small cast of a Phœnician tomb.

SWEDEN.

The geological survey of Sweden, Stockholm, transmitted, in ex- ge, specimens of Cambrian fossils.

SWITZERLAND.

Prof. H. de Saussure, Museum of Natural History, Geneva, sent specimens of orthoptera.

OCEANICA.

AUSTRALASIA.

AUSTRALIA.

New South Wales.—From the Australian Museum, through Dr. E. P. Ramsay, curator, was received a collection of birds' skins, mammals, echinoderms, graptolites, and specimens of crustaceans and asteroidea.

Dr. C. C. Cox, through Mr. Charles Headley, Australian Museum, Sidney, New South Wales, transmitted alcoholic specimens of *Ephippodonta Macdougalli* Tate, a very remarkable bivalve mollusk, recently described, from Australia.

NEW CALEDONIA.

From Rev. H. B. Tristram, The College, Durham, England, were received birds' skins in exchange.

NEW GUINEA.

From Dr. James Rodman, Hickman, Ky., was obtained by purchase a superb bird of paradise (*Lophorhina superba*).

The Royal Zoölogical Museum, Florence, Italy, through Prof. Henry Giglioli, director, transmitted archæological objects in exchange.

Rev. H. B. Tristram, The College, Durham, England, transmitted birds' skins in exchange.

QUEENSLAND.

Mr. S. F. Denton, U. S. Fish Commission, presented a skin of white-bellied sea eagle (*Haliaëtus leucogaster*) or allied species.

From Mr. E. E. Howell, Washington, D. C., were received, in exchange, specimens of cut and rough opals.

VICTORIA.

From the Department of Agriculture, through Prof. C. V. Riley, entomologist, were received specimens of Australian hemiptera, collected by Mr. J. G. O. Tepper, of Adelaide.

From Mr. W. T. Bednall, of the South Australian Museum, was received a specimen of *Antheræa eucalypti.*

NEW ZEALAND.

From the Department of Agriculture, through Prof. Riley, were received specimens of New Zealand *Coccinellidæ*, collected by Mr. D. W. Coquillet.

From the Auckland Museum, through Prof. T. F. Cheeseman, curator, were received in exchange botanical specimens, insects, birds' skins and skeletons.

The Otago Museum, Dunedin, through Dr. T. Jeffrey Parker, director, transmitted specimens of crustaceans in exchange.

Mr. Charles T. Simpson, U. S. National Museum, presented dried specimens of *Lepas hillii.*

MALAYSIA.

From Mr. Victor A. Jenny, consular agent at Macassar, Celebes, were received specimens of shells, ethnological objects, and three musical instruments, collected by him for the National Museum.

Hon. Alexander Webb, United States consul, Manila, Philippine Islands, transmitted to the Museum musical instruments collected by him for the National Museum.

Hon. Rounsevelle Wildman, United States consul, Singapore, Straits Settlements, transmitted Malayan musical instruments and ethnological objects collected by him for the National Museum.

POLYNESIA.

HAWAIIAN ISLANDS.

Lieut. T. G. Fillette, U. S. Navy, deposited a cane of palm-wood with handle made of a wild boar's tusk, gold-mounted, presented to him by King Kalakaua.

From Mr. Scott B. Wilson, Heatherbank, Weybridge, Surrey, England, was obtained, by purchase, a skin of Baillou's grosbeak (*Loxioides bailloui*).

SAMOAN ISLANDS.

From Hon. Harold M. Sewall, United States consul, was received a collection of Samoan musical instruments.

From Ward's Natural Science Establishment, Rochester, N. Y., was received the type of the flying fox, *Pteropus lanigera.*

H.—COÖPERATION OF THE DEPARTMENTS AND BUREAUS OF THE GOVERNMENT DURING THE YEAR ENDING JUNE 30, 1892.

The National Museum during the past year has been the recipient of numerous contributions from the different bureaus of the Government, as will be seen from the following statements:

DEPARTMENT OF STATE.

From the Department were received specimens of Indian wool, woolen yarns and fabrics; also samples of Indian wool, collected by Consul-General Samuel Merrill, Calcutta, India, assisted by Mr. T. N. Mukharji, assistant curator of the Indian Museum, and a report by Mr. Samuel Merrill relating to sheep and wool in India; wool and woolen fabrics from Chitteldroog and Davengire Tuluks in the Chitteldroog district, Mysore Province, contributed by Mr. L. Ricketts, director of statistics and agriculture in the Mysore Bungalore, also transmitted by Mr. Merrill to the Department of State and transferred to the National Museum.

From Mr. R. M. Bartleman, of the United States legation at Carácas, Venezuela, were received photographs of native scenery and other objects of interest in Venezuela, also of the shores of the lagoon of Lake Sinamaica, Goajira Lake dwellings, and a group of Goajira Indians.

Hon. Truxton Beale, United States consul, Teheran, Persia, transmitted to the Department of State, three molds of sculptures from Persepolis, which were transferred to the Museum.

Consul-general John M. Crawford, St. Petersburg, Russia, kindly forwarded, through the State Department, a collection of castings of figures, ethnological objects, iron ores, and sample of the sand from which the castings are made, obtained by Mr. George F. Kunz, of Hoboken, N. J., for the National Museum.

Mr. Charles de Struve, envoy extraordinary and minister plenipotentiary, Russian legation, Washington, D. C., presented 39 sheets of ethnological portraits of the inhabitants of Russia.

Mr. Victor A. Jenny, consular agent at Macassar, Celebes, transmitted three musical instruments, specimens of shells, and ethnological objects.

Mr. William P. Pierce, United States consul at Trinidad, West Indies, forwarded through the Department of State, in behalf of Dr. J. F. Chittenden of the Victoria Institute, specimens of sole (*Achirus lineatus* and *Azevia* n. sp.).

From Mr. Harold M. Sewall, United States consul, Apia, Samoa, were received a number of native musical instruments.

Mr. R. W. Turner, United States consul, Cadiz, Spain, transmitted a door formerly used in the convent of La Rabida at Palos, and a small cast of a Phœnician tomb.

From Mr. Alexander R. Webb, United States consul, Manila, Philippine Islands, were received ethnological objects and musical instruments used by the natives.

Mr. Rounsevelle Wildmann, United States consul, Singapore, Straits Settlements, transmitted a collection of Dyak and Malayan ethnological objects, shells, corals, and musical instruments.

TREASURY DEPARTMENT.

The requests for free entry which have heretofore been extended by the Treasury Department to the National Museum in connection with collections from foreign countries, have as usual been complied with. The bureaus named below have shown much interest in the work of the Museum, and have rendered valuable assistance in procuring contributions:

U. S. Coast and Geodetic Survey.—Through Dr. T. C. Mendenhall, Superintendent, was received a collection of insects, mammals, birds' skins, fishes, geological material, birds' eggs and a nest, collected by Assistant J. E. McGrath during his expedition to Alaska.

U. S. Life-Saving Service.—From this Bureau were received specimens of quartz pebbles, 2 sea-horses (*Hippocampus hudsonius*), and a fossil crab, collected at Ocean City life-saving station by Capt. J. J. Dunton, keeper, and also a skeleton of *Physeter macrocephalus* juv. from Green Run Inlet, collected by Capt. Dunton.

U. S. Revenue-Marine Service.—From Capt. M. A. Healy, through Lieut. D. H. Jarvis, both of the steamer *Bear*, was received the skin of a female walrus (*Odobœnus obesus*), captured in Holy Cross Bay, Siberia.

WAR DEPARTMENT AND THE ARMY.

Several officers of the Army have contributed material to the Museum collections, and very valuable assistance has been rendered by the Quartermaster's Department in connection with the transportation of heavy material to Washington.

Gen. M. C. Meigs, Quartermaster-General (retired), presented a revolving rifle (in a mahogany case) of early pattern, invented about 1835, and made in Rochester, N. Y.

A large collection of bronze medals, intaglios, antique stones, and other objects of a similar nature were deposited in the Museum by the executors of Gen. Meigs's estate, as a bequest from him to the National Museum.

Col. R. I. Dodge (retired), Sacketts Harbor, N. Y., transmitted 4 specimens of horse-fly (*Gathophilus equi* Fab.) and a Wasp (*Pelecinus polycerator*).

From Maj. William H. Powell, Fort Keogh, Mont., was received, through Dr. D. P. Wolhaupter, of Washington, D. C., a pipe belonging to Washakie, an Arapahoe chief, presented to Maj. Powell by him during the campaign of 1876.

Capt. Charles E. Bendire, curator of birds' eggs in the National Museum, presented the skin of an American pipit (*Anthus pensilvanicus*) from Lockport, N. Y., a set of eggs of *Tantalus loculator* from Yucatan, and deposited a buffalo robe, lance-holder (rawhide beaded), and a beaded quiver made of otter skin.

Capt. John G. Bourke, Fort Ringgold, Tex., presented a collection of Guadalajara pottery, specimens of materia medica obtained from a Mexican woman, samples of folk-medicine from Lower Rio Grande Valley, and salt crystals from the El Sal del Rey Lake in southern Texas. Capt. Bourke deposited three votive offerings, soles of the "guarachi," or sandals used by the Mexican foot-troops along the Rio Grande, a throwing-stick, and a bird-spear from Mexico, Lieut. Harry C. Benson, Fort Walla Walla, Wash., transmitted nests and eggs of *Trochilus alexandri* with skins of the same, sets of eggs of *Buteo swainsoni* and *Accipiter cooperi* from St. Louis ranch, San Joaquin Valley, California, and Santa Lucia Valley.

From Dr. Edgar A. Mearns, Fort Snelling, Minn., were received birds' eggs and skins, mammal skins, turtle, and forty-eight species of shells. In connection with his work on the International Boundary Commission, Dr. Mearns obtained for the Museum a collection of birds' skins and eggs, turtles, and mammal skins, birds' eggs, birds' nests, rocks, shells, fossils, mammal skulls, cocoon of bag worm, and fishes.

Dr. J. H. Porter, Army Medical Museum, Washington, D. C., transmitted two human skulls, piece of bone, and 4 stone implements from Rockingham County, Va.

From Dr. R. W. Shufeldt, Takoma Park, D. C., were received birds' nests and skins; model of a fossil bird, *Archæopteryx macrura*, from Solenhofen, Bavaria; nest of prairie warbler (*Dendroica discolor*) from Takoma Park; a skin of Wilson's snipe (*Gallinajo delicata*) from Fort Wingate, N. Mex.; specimen of *Carinifex Newbergi*, from the Equus beds, Fossil Lake, Oregon, and a specimen of iguana.

Dr. Timothy E. Wilcox, Fort Huachuca, Ariz., presented a collection of mammals, insects, reptiles, fishes, and birds,* and a living horned toad.

From Dr. Charles E. Woodruff, Fort Missoula, Mont., through Mr. Garrick Mallery, of the Bureau of Ethnology, were deposited thirty-seven photographs pertaining to the Hoopa Valley Indians of California, and presented a stone baking-dish obtained from the same tribe of Indians.

From Rev. J. H. Potter, Fort Clark, Tex., was received a large specimen of fresh-water shrimp.

Mr. Frank X. Holzner, Fort Snelling, Minn., presented specimens of mammals and birds' skins.

Mr. Charles R. Fosdick, of the War Department, transmitted a starfish with nine rays.

NAVY DEPARTMENT AND THE NAVY.

Admiral Jouett and Mrs. Jouett deposited a dish and ewer of "precious metals," presented to the Admiral for services rendered in saving from shipwreck the British steamship *Historian* in the Caribbean Sea in 1885.

From Lieut. George F. Emmons, Sitka, Alaska, was received a fish-knife made in Siberia, and preserved as a relic of the old Russian days.

From Lieut. T. G. Fillette were received seven pictures illustrating the Chinese idea of the war in Tonkin, and a show bill, "Chiarinis show in China." Mr. Fillette deposited a cane made of palm-wood, with a handle carved from the head of a wild boar, presented to him by King Kalakaua, of the Hawaiian Islands.

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*Dr. Wilcox was assisted in obtaining this collection by Miss Florence Wilcox, Lieuts. J. A. Emery and Simpson, Dr. R. G. Ebert, Master Harry Ebert, Master Fred Fowler, Master Glover Wilcox, and Mr. Leah, hospital steward.

Lieut. G. H. Harber transmitted portions of a fur costume, made by the Yokuti of North Siberia and worn by him on the Lena Delta, during his connection with the *Jeannette* relief expedition.

Lieut. Charles F. Pond, Mare Island Navy-Yard, California, transmitted a specimen of sphinx moth (*Smerinthus ophthalmicus* Bd.).

From Lieut. F. E. Sawyer were received specimens of crustaceans collected in Brazil.

Ensign Roger Wells, jr., obtained a specimen of cayman (juv.) from Trinidad, West Indies, which he transmitted to the National Zoölogical Park. The specimen was transferred to the National Museum by Dr. Baker, acting manager.

Dr. Howard E. Ames transmitted a bird skin, reptiles, fishes, crustaceans, ophiurans, and insects from the West Indies and South America.

From Dr. W. H. Rush were received shells from the eastern coast of South America.

From Dr. C. H. White was received a miscellaneous collection of insects made at Acapulco, Mexico, and Payta, Peru. Dr. White also presented a specimen of crude nitrate of soda from Iquique, Chile.

From the United States Naval Eclipse Expedition were received seven birds' skins, representing two species, from Ascension and St. Helena islands.

Dr. James M. Flint, under whose efficient supervision, as honorary curator, the collection of materia medica has been developed, was recalled in November, 1891, by the Secretary of the Navy. He was succeeded by Dr. J. C. Boyd, who, in April, 1892, was succeeded by Dr. William S. Dixon.

DEPARTMENT OF THE INTERIOR.

Indian Office.—From Mr. George A. Allen, United States Indian agent, Colorado River Agency, Parker, Ariz., were received specimens of *Pepsis formosa* Say and *Sphærophthalma creusa* Cress., skins of two rare bats, *Macrotus californicus* and *Molossus californicus*, and specimens of *Trombidium*, n. sp., near *giganteum* Riley.

Dr. Z. T. Daniel transmitted several contributions from Cheyenne River Agency, S. Dak., and Blackfeet Indian Agency, Mont., among which were archæological objects from an ancient Indian village site near Fort Bennett; ethnological objects found in a camp of "Big Foot's" people; lock of hair cut from the head of "Yellow Thigh and Red Star," a Yankton Sioux Indian and a participant in the Custer battle; scraper from the ruins of a Ree village; moccasin-shaped stone from Montana; plum seeds, "kansu," used by the Sioux Indians for gambling purposes, and a ration ticket of "Banged-in-the-Eye;"

wooden spoon obtained from an Indian of the Piegan tribe, Montana; archæological objects, chalcedonic concretions, and specimens of water-worn chalcedony; pipe made by "Afraid-of-Nothing," a Sioux Indian, and a pipe pouch made by an Indian of the same tribe; specimen of hawk moth (*Hemaris diffinis* Bd).

Pension Office.—From Mr. W. W. Cheshire was received a photograph of the breastbone of a wild goose, perforated by an Eskimo arrow.

From Merritt Lewis, esq., was received a carved stone pipe from Clinton County, Mich.

U. S. Geological Survey.—The following statement will show the extent of the accessions transmitted by the Survey during the year:

Through Maj. J. W. Powell, director, was received a collection of vertebrate fossils obtained from the estate of the late Dr. Joseph Leidy; specimen of pyrolusite from 1 mile west of Walnut Grove, in Murphrees Valley, Etowah County, Ala.; 2 specimens of bornite from Gillis Company's mine, Guilford County, N. C.; a large collection of cretaceous invertebrate fossils, gathered in Alabama, Mississippi, Texas, Oregon, Washington, California, Dakota, Colorado, Wyoming, Utah and Montana; chalcedony from Frankfort, Ky.; specimens of minerals from various localities, consisting of agate, selenite, satin spar, calcite, fluorite, quartz, phlogopite, chalcedony, massive apatite, stalactite, dolomite and calcite, and kaolin in quartz geodes; 2 specimens of sphalerite, 11 specimens of calamine, a specimen of galena, and 4 specimens of calcite from Aurora, Mo.; minerals, consisting of pink grossularite, tridymite, orthoclase, sylvanite, emplectite, fluorite, mimetite, Jamesonite, adularia, smoky quartz, tourmaline, wernerite and strontianite; 40 specimens of galena and 15 of sphalerite from Joplin, Mo.; collection of fossil insects, constituting the group mentioned, described and figured by Prof. S. H. Scudder, of the Geological Survey, Vol. XIII, Hayden Reports; specimen of wavellite from Steamboat Springs, Chester County, Pa.

Collected by Dr. T. M. Chatard, 46 specimens of minerals from North Carolina, 10 specimens from Georgia, and a specimen from Pennsylvania, consisting of lucasite, asbestus, corundum, vermiculite, enstatite, talc, garnet, sunstone, andesite, diaspore, chrysolite, margarite, amphibole and spinel.

Collected by Mr. David A. Harrah, Burchard, Nebr., tooth of *Petalodus destructor*, a carboniferous selachian.

Collected by Dr. W. P. Jenney, 4 specimens of galena, 12 specimens of calcite on galena from Joplin., Mo.; 19 specimens of pyrite, sphalerite, cerussite and smithsonite from Galena, Kans.

Collected by Mr. W. Lindgren, 34 specimens of radiated brown tourmaline from Colfax, Nevada County, Cal.

Collected by Prof. O. C. Marsh, specimens of invertebrate fossils transferred from the Survey to the Museum.

Collected by Dr. W. H. Melville, minerals from Dillon, Mont.: 29

specimens of minerals, consisting of barite, galena, plattnerite, garnet and cerussite from Mullan, Idaho.

Collected by Dr. J. S. Newberry, Columbia College, New York City, specimens of fossil plants transmitted to the Survey and transferred to the Museum.

Collected by Prof. S. L. Penfield, 59 specimens of minerals from Colorado, consisting of aragonite, cerussite, pyrite, native gold, rhodochrosite, galena, orthoclase crystals, embolite, hyalite, and calcite, specimen of hubnerite from North Star mine, and 2 of guitermanite and zunyite from Zuñi mine near Silverton, Colo. (deposit), specimen of rock showing slickensides from central Colorado.

Collected by Mr. I. C. Russell, 2-pairs of snow-shoes from Charley's Village, Yukon River.

Collected by Mr. H. W. Turner, 5 specimens of garnet and 4 specimens of epidote.

From Mr. Frank Burns was received an iron tomahawk from Blount County, Ala.

Dr. T. M. Chatard deposited a scarf pin made of cassiterite from Chesterfield County, S. C.

From Miss May Clark was received a fetish (mole) from New Mexico (exchange).

Mr. William H. Dall transmitted 10 specimens of mollusks from Baddeck, Cape Breton Island, Nova Scotia; 6 albums containing photographs of ethnological objects and celebrated men, and a daguerrotype of Rev. C. H. A. Dall, of Harvard College.

From Mr. L. G. Eakins was received a specimen of gadolinite from Llano County, Tex., and a specimen of native gold in quartz from the Potomac mine, Montgomery County, Md.

Dr. W. P. Jenney transmitted ores from Arkansas, 2 specimens of cadminiferous smithsonite from Morning Star mine, Marion County, Ark., a specimen of rubellite from San Diego, Cal., and one of kyanite from Windham, Me.

From Mr. L. C. Johnson were received fresh-water shells from Waddell's mill pond, near Marianna, Fla.

From Mr. W. Lindgren were received rocks and ores from Lake Valley, New Mexico.

From Mr. S. Ward Loper were received 6 specimens of banded jasper from Crown City, Colo.; 2 slabs of shale with rain-prints from Durham, Conn., and a specimen of augite rock from East Rock, New Haven, Conn.

Mr. W J McGee transmitted silver ores from Mexico.

From Mr. R. H. Payne was received an enamel picture on glass, transferred from stone.

Mr. I. C. Russell transmitted a collection of Eskimo ivory carvings, dishes, spoons, pipes, daggers, and ethnological objects of various kinds from the Upper Yukon River, Alaska.

From Dr. R. E. C. Stearns were received 4 specimens of shrimp from the western coast of North America, and a garter-snake from Berkeley, Cal.

Mr. H. W. Turner transmitted an alcoholic specimen of shrew (*Sorex vagrans*).

From Mr. C. D. Walcott was received contorted slate from near Wells, Rutland County, Vt.; 5 echinoids, 5 specimens of flint, and tooth of a shark from the cretaceous chalk of Croydon, England, and 4 specimens of calcite from Smith's Basin, Washington County, N. Y.

Several of the honorary curators in the National Museum are officers of the Geological Survey, and the Museum is much indebted to them for their valuable coöperation with the work of the Museum. These are Mr. C. D. Walcott, in charge of paleozoic fossils; Dr. C. A. White, in charge of mesozoic fossils; Mr. William H. Dall, in charge of mollusks and cenozoic fossils; Prof. Lester F. Ward, in charge of fossil plants; Prof. F. W. Clarke, in charge of minerals, and Prof. O. C. Marsh, in charge of vertebrate fossils.

DEPARTMENT OF AGRICULTURE.

From the Department of Agriculture, through the Secretary, have been received the following objects:

Collection of land and fresh-water shells from various localities in Arizona and in the vicinity of Death Valley.

Three Gray seals from Labrador.

From the Division of Forestry were received 37 photographs representing species of woods, 18 photomicrographs of woods of the United States (deposited), and 12 distribution charts of trees of the United States, prepared by Mr. C. S. Sargent, special agent of the Tenth Census.

Through the Division of Economic Ornithology, were received specimens of land and fresh-water shells from Brownsville, Tex., collected by Mr. William Lloyd; 3 portions of *Elephas* bones, 323 birds' eggs, and 55 birds' nests from California, Nevada, Utah and Texas.

Through Prof. C. V. Riley, entomologist: specimens of North American coleoptera, representing 24 species, new to the collection; collection of insects of all orders, made in the Northwestern States, British Columbia and Alaska; 55 specimens of Californian orthoptera, representing 21 species; 78 specimens, representing 25 species of insects, mostly lepidoptera; large series of hymenoptera and homoptera from southern California; 43 specimens, representing 17 species of neuroptera; 31 specimens, representing 7 species of orthoptera; 130 specimens, representing 43 species of hemiptera, from Los Angeles; 28 specimens, representing 4 species of Australian *Coccinellidæ*; 245 specimens, representing 51 species of Californian coleoptera; 81 specimens, representing 31 species of Californian lepidoptera; 200 specimens, representing 59 species of Californian hymenoptera; 246 specimens, representing 64 species of Californian hemiptera; 182 specimens, representing 18 species of diptera (*Bombylidæ*), including types of new species; 236 specimens, representing 35 species of North American coleoptera and 25 specimens of New Zealand *Coccinellidæ;* 5 new species of *Bombylidæ*, consisting of *Lordotus junceus* Coq., *Lordotus diversus* Coq., *Toxophora vasta* Coq., *Paracosmus insolens* Coq., *Amphicosmus elegans* Coq., 8 species of rare coleoptera, and 7 species of rare orthoptera; 170 specimens, representing 11 species of rare coleoptera, new to the collection, from San Diego and Los Angeles counties, collected by Mr. D. W. Coquillet; 3,473 specimens, representing 636 species of insects obtained by Mr. A. Koebele during his connection with the Death Valley Expedition; 200 specimens, representing insects of various orders, collected by Mr. C. G. Schaupp, in Burnet County, Tex.; and a miscellaneous collection of insects, including biologic material also collected by Mr. Schaupp at Cypress Mills, Tex.; specimens of Australian hemiptera, representing 8 species, collected by Mr. J. G. O. Tepper, of Adelaide.

Through Dr. George Vasey, botanist: specimen of "Travellers Tree," from Mexico.

From Mr. Frank H. Hitchcock were received 3 meadow larks, 3 sparrow hawks, a blue jay, a red-tailed hawk from Maryland, and a tortoise collected by Mr. E. A. Preble from the Potomac Flats.

From Mr. S. B. Johnson, through Mr. F. W. Malley, assistant entomologist, was received the upper jaw bone of a paddle fish (*Polyodon folium*) from a stratum of rock at Rocky Point, La.

From Mr. Charles W. Richmond were received 3,000 specimens of birds' skins from the District of Columbia; 152 specimens of reptiles and batrachians from various localities; 12 birds (chiefly owls), representing 6 species, from Sandy Spring, Md., red-tailed hawk, sparrow-hawk, broad-winged hawk, sharp-shinned hawk, Cooper's hawk, long-eared owl, from Maryland; 35 specimens, representing 6 species of birds' skins, from the District of Columbia.

From Dr. A. Charles True were received 6 specimens of cretaceous fossils from Uniontown, Ala., teeth of *Corax prislodontus* and *Lamna elegans*, tooth of *Lamna cuspidota*, and vertebra of *Lestosaurus* from the same locality.

From Mr. H. E. Van Deman was received a specimen of black skimmer.

Mr. Harry G. White transmitted a specimen of red-tailed hawk and a short-eared owl in flesh from Arlington, Va.

The very valuable services rendered by Prof. Riley, honorary curator of insects; Dr. B. E. Fernow, honorary curator of the section of forestry; and Dr. George Vasey, honorary curator of the department of botany, have been continued and are hereby acknowledged.

UNITED STATES FISH COMMISSION.

The following collections and contributions have been transmitted to the National Museum through Col. Marshall McDonald, U. S. Commissioner of Fisheries:

Four photographs of Alaskan Indians and their houses; frog from Grenadier Island, New York; specimens of *Avian entozoa* from Yellowstone Park, described by Prof. Edward Linton; 955 specimens of fishes, representing 15 species, including *Leuciscus gilli*, a new species, collected in Montana and Wyoming during the summer of 1891 by a Fish Commission party under the direction of Prof. B. W. Evermann; collection of reptiles and batrachians made by Prof. Evermann in Montana and Wyoming, in 1891; specimens of fishes representing the following species: *Lutjanus blackfordi*, *Haploidonotus grunniens*, *Pomadasys virginicus*, *Epinephelus morio*, *Ictiobus bubalus*, *Stoasodon narinari*, *Serranus atrarius*, *Menticirrus nebulosus*, *Cynoscion regale*, *Clupea harengus*, *Merlucius bilinearis*, *Phycis chuss*, *Lophopsetta maculata*, *Esox lucius*, *Cottus octodecimspinosus*, *Pomoxys*, *Pleuronectes americanus*, *Roccus chrysops*, *Roncador stearnsi*, *Pleuronectes stellatus*, *Ophiodon elongatus*, *Micropterus dolomieu*, *Lampris luna*, *Phycis*, *Brosmius brosme*, *Pleuronectes americanus*, *Pollachius carbonarius*, *Cottus octodecimspinosus*, *Citharichthys sordidus*, *Paralichthys californicus*, *Pleuronectes stellatus*, *Psettichthys melanostictus*, *Sebastichthys auriculatus*, *Ophiodon elongatus*, *Raia ocellata*, *Batrachus tau*, *Cyprinus carpio*, *Alutera schoepffi*, *Liostomus xanthurus*, *Pomadasys fulvomaculatus*, *Onchorhynchus chouicha* and *Ruvettus temminckii*; specimen of turtle, *Aspidonectes spinifer*; specimen of tarpon and Logger-head turtle; plants obtained in Alaska during the cruise of the steamer *Albatross* in 1889 and 1890; plants from the Galapagos Islands, obtained during the cruise of the steamer *Albatross*, under the direction of Prof. Alexander Agassiz; alcoholic specimens of birds, reptiles, insects, rocks, birds' nests, and skeletons; collection of crustaceans, chiefly from the North Pacific Ocean, made by the *Albatross* during the past three or four years; alcoholic specimens of lizards and shells from Cozumel Island, off the coast of Central America, collected in 1885; skin of coast fox, *Urocyon virginianus littoralis* from Santa Rosa Island, California; collection of birds' skins from the Galapagos Islands and Alaska, and birds' eggs from Alaska, collected by Mr. C. H. Townsend, of the steamer *Albatross*; 117 birds' skins from the Galapagos Islands, collected in March and April of 1891 by the steamer *Albatross*, under the direction of Mr. Townsend, and the skin and skull of a brown bear, shot by Mr. Townsend at Port Moller.

Through Mr. Richard Rathbun, acting commissioner: Small collections of crustaceans, chiefly from the dredgings of the steamer *Albatross* in the Pacific Ocean, but including a few specimens from the Atlantic.

From Mr. W. H. Abbott were received specimens of *Corydalus cornutus* and *Orthosoma brunneum*.

Dr. Tarleton H. Bean presented the skin of a red phalarope and a turtle.

From Mr. S. F. Denton was received the skin of a white-bellied sea eagle (*Haliaëtus leucogaster*) or an allied species, from Queensland, Australia, and a bat, *Vesperugo serotinus*, in flesh.

Mr. Vinal N. Edwards transmitted a specimen of American scoter (*Oidemia Americana*) from Wood's Holl, Mass.

Specimens of reptiles and batrachians collected by Prof. B. W. Evermann during the fall of 1891 in Missouri and Texas were deposited by him.

From Mr. R. R. Gurley were received specimens of seeds and shells from Texas.

Mr. Richard Rathbun transmitted a small collection of *Panopeus* from Brazil, collected in 1875–'76.

From William P. Seal were received 3 specimens of American pipit (*Anthus pensilvanicus*) from Alexandria, Va.

Dr. Hugh M. Smith transmitted 7 specimens of *Acris gryllus*, a series of 8 human hyoids, a set of human ear bones, and 5 mud puppies (*Necturus lateralis*).

From Mr. Charles H. Townsend were received 5 skins of *Eumetopias stelleri* and 2 skins of *Phoca vitulina*, collected near Monterey, Cal.

The valuable services of Mr. Richard Rathbun as honorary curator of marine invertebrates; Dr. Tarleton H. Bean as honorary curator of fishes, and Capt. J. W. Collins as honorary curator of fisheries and naval architecture have, through the courtesy of Col. McDonald, U. S. Commissioner of Fisheries, been continued.

DEPARTMENT OF JUSTICE.

From Col. Cecil Clay, were obtained five specimens of woodland caribou from Newfoundland.

BUREAU OF ETHNOLOGY.

The following contributions have been received from the bureau and its officers:

Through Maj. J. W. Powell, director: collection of archæological objects and specimens of pottery obtained from a mound near Linville, Rockingham County, Va.; 370 ethnological objects collected by Mr. James Mooney from the Kiowa Indians of Oklahoma Territory; collection of scrolls of birch-bark and mnemonic songs, collected by Dr. W. J. Hoffman in Minnesota during the years 1887, 1888, 1889, and 1890, relating to the ritual of the Society of Shamans.

From Dr. A. S. Gatschet was received a winnowing basket made in 1877 by an Indian belonging to the Klamath tribe, southwest Oregon, and specimens of Indian food obtained from the same tribe.

From Mr. H. W. Henshaw was received a valuable set of mounted herbarium plants, representing the fauna *Quercus*, *Aster* and *Solidago* from the District of Columbia, and a collection of fishes, reptiles, and batrachians from Virginia and the District of Columbia.

Mr. W. H. Holmes transmitted 3 rude implements made from novaculite, obtained from an ancient Indian quarry in Indian Territory.

From Mr. Cosmos Mindeleff was received a specimen of calcite pseudomorph after glauberite from Rio Verde, Arizona.

Mr. James Mooney transmitted ethnological objects obtained from the Piute Indians.

Mrs. M. E. Stevenson presented 2 fetiches (bear) from New Mexico, and deposited 4 feather-plumes and a stone object obtained from the Zuñi Indians.

I.—EXPLORATIONS.

The collections of the Museum have been very materially increased during the year through the coöperation of various collectors, commissioned by the Smithsonian Institution or the Museum, as well as through the interest and courtesy of friends of the Museum who have voluntarily offered their services in procuring material for the Museum. The collections which have resulted from the assistance of these persons are here referred to.

Dr. W. L. Abbott, whose contributions to the Museum have for many years been so generous and acceptable, has added a very interesting and valuable collection chiefly from Kashmir and Baltistan, comprising ethnological objects, birds' skins, mammal skins and skulls, and including specimens of the Himalayan ibex and Vigne's sheep.

From the Department of Agriculture, through Prof. C. V. Riley, entomologist, were received 3,473 specimens, representing 636 species of insects, collected by Mr. A. Koebele, during his connection with the Death Valley expedition in March and April of 1889. These specimens were transferred from the Department of Agriculture to the National Museum.

The Museum has also been the recipient of land and fresh-water shells from the same locality, obtained during the same expedition.

Mr. James E. Benedict, of the National Museum, was engaged in an exploring trip in the vicinity of Point Lookout for the purpose of obtaining marine invertebrates for the Museum. He was successful in his undertaking and added several very interesting specimens to the collection.

Mr. R. M. Bartleman, of the United States legation, Carácas, Venezuela, expressed his willingness to obtain views for the National Museum, and he was accordingly furnished with a photographic outfit for that purpose. An interesting series of photographs, representing native scenery and other objects connected with Venezuelan life and the surrounding country, has been received from him.

In the chapter on explorations, contained in the Report of the National Museum for 1890, mention was made of an exploring expedition which had been sent into the unexplored lands of Africa by the British South African Exploring Society. This expedition was joined by Mr. William Harvey Brown, who was sent out under the auspices of the Smithsonian Institution in connection with the Naval Eclipse Expedition, and who had made during the previous year large and valuable additions to the collections of the National Museum. In a letter recently received from him he states that he has secured for the Museum natural history specimens, including several head of large game from the Umswezi River. These specimens have not yet been received. The only material received from him during the present year are six birds' skins, representing four species from Angola.

Mr. J. H. Camp, Leopoldville, Congo district, Africa, in a letter dated December 29, 1891, offered to collect natural history specimens for the National Museum. A collection of African butterflies, photographs of natives, and botanical specimens has been received from him.

Mr. William Astor Chanler, of New York City, visited the Smithsonian Institution in September, 1891, and kindly offered during his proposed travels in Africa to make collections for the Smithsonian Institution. His offer was gladly accepted, and the result of his exploration in connection with the Institution will be given in a later report.

The U. S. Fish Commission has transferred several large and interesting collections to the National Museum during the year. Among them are valuable collections of plants from the Galapagos Islands and Alaska, collected by the *Albatross*, under the direction of Prof. Alexander Agassiz; a collection of birds, rocks, insects, batrachians, birds' skeletons and nests, also collected by the steamer *Albatross;* specimens of crustaceans collected by the *Albatross* in the North Pacific Ocean, and birds from the Galapagos Islands obtained by the same steamer, under the direction of Mr. Charles H. Townsend.

The U. S. Geological Survey, has, through its director, Maj. J. W. Powell, added largely to the mineral collections of the National Museum, as well as by the contributions made by individuals connected with the Survey while engaged in field-work in different parts of the country.

On September 15, 1891, letters of introduction to James P. Turnbull, United States consular agent, San Luis Potosi; Hon. Thomas Ryan, Minister to Mexico; Rev. George B. Winton, and Dr. Pagenstecher were given to Mr. P. L. Jouy, of the National Museum, who visited Mexico for the purpose of making collections of natural history specimens for the National Museum. The results of his expedition will be recorded in the next Report.

Dr. Edgar A. Mearns, U. S. Army, while engaged in his work with the International Boundary Commission, kindly offered to collect natural history specimens for the National Museum. There have already been received from him several very interesting collections, and a full report of those not mentioned in the accession list accompanying the present Report, will be given in the Report for 1893.

Mr. George P. Merrill, of the National Museum, engaged in an exploring expedition through Arizona and New Mexico, and secured for the Museum some beautiful specimens of onyx marble and other acceptable geological material. In Virginia and adjoining States he also obtained interesting ores and marbles.

Mr. Newhall, of the National Museum, while engaged in field-work for the Museum, obtained rocks, ores, and conglomerates from Virginia and New Jersey.

Mr. Charles W. Richmond, Department of Agriculture, in a recent trip through Guatemala and Nicaragua, by an agreement made with the National Museum, secured several large collections of natural history specimens. A detailed report of these collections will be found by reference to the accession list (Section V), and the material received after the close of the present fiscal year will be recorded in the next Report.

In addition to the collections which have heretofore been received from Mr. I. C. Russell, of the U. S. Geological Survey, in connection with his explorations in Alaska, he has generously contributed a number of ethnological objects, consisting of Eskimo ivory carvings, dishes, spoons, pipes, daggers, dolls, trinkets, etc., from the Upper Yukon River.

Dr. Timothy E. Wilcox, U.S. Army, Fort Huachuca, Ariz., has continued to transmit specimens for the National Museum from the vicinity of Fort Huachuca. Some very rare specimens of reptiles have been received from him.

Mr. Thomas Wilson, curator of Prehistoric Anthropology in the National Museum, was present at the opening of the Hopewell mine in Chillicothe, Ohio. The objects exhumed consisted of copper spools, copper pieces, bones, mica cut into stencils, a broken effigy, boat-shaped objects of stone, beads made of bone, and a large number of pearls bored or drilled, etc.

Mr. William S. Yeates, assistant curator of minerals in the National Museum, collected specimens in North Carolina, and secured some very acceptable minerals and Miocene fossils.

COLLECTORS' OUTFITS.

During the fiscal year ending June, 1892, the following collecting outfits have been furnished by the Museum:

1891.

July 3.—To Dr. J. T. Scoville, Terre Haute, Ind. Copper tanks, tank-box, alcohol, etc., to be used in collecting and preserving natural history specimens for the National Museum. A list of the specimens received from him will be found in the accession list (Section V).

July 13.—To Capt. John G. Bourke, U. S. Army, Fort Ringgold, Tex. An outfit for collecting plants.

July 21.—To Mr. W. W. Rockhill, Berkeley Springs, W. Va., in connection with his expedition to the Chinese Empire. Collecting implements and other apparatus to be used in obtaining specimens for the National Museum.

August 15.—To Mr. James E. Benedict, of the U. S. National Museum, in connection with his collecting trip in the vicinity of Point Lookout. Necessary outfit for collecting and preserving specimens. The collections received from him are referred to in the accession list (Section V).

August 25.—To Mr. R. M. Bartleman, U. S. Legation, Carácas, Venezuela. A photographic outfit, to be used in obtaining views for the Museum collection. The photographs received from him are referred to in the accession list (Section V).

To Dr. R. R. Gurley, U. S. Fish Commission. Two copper tanks for the preservation of natural history specimens for the National Museum. Reference to the collections received from him is made in the accession list (Section V).

To Dr. Timothy E. Wilcox, U. S. Army, Fort Huachuca, Ariz. Apparatus and material for preserving and collecting natural history specimens. Several collections have been received from him, reference to them being made in the accession list (Section V). Other collections received from him will be referred to in the accession list of the Museum Report for 1893.

October 1.—To Mr. P. L. Jouy, U. S. National Museum. A very extensive collecting outfit, to be used in obtaining and preserving natural history specimens during his travels in Mexico. A list of the specimens obtained by him will appear in the accession list of the Museum Report for 1893.

October 6.—To Mr. Héli Chatelain, consular agent, Loanda, Africa. An outfit to be used in collecting and preserving natural history specimens and other objects for the National Museum.

November 19.—To Mr. R. M. Bartleman, U. S. Legation, Carácas, Venezuela. Photographic outfit, to be used in obtaining views for the National Museum.

December 1 and 15.—To Mr. Charles W. Richmond, Department of Agriculture. Copper tanks, tank-boxes, alcohol, etc., to be used in collecting and preserving natural history specimens for the Museum. A very large and interesting collection has been received from Mr. Richmond, obtained from the vicinity of Guatemala, and is referred to in the accession list (Section V).

December 10.—To Mr. Charles T. Simpson, U. S. National Museum, Mason jars, alcohol, net, canvas, etc., to be used in collecting and preserving natural history specimens.

1892.

February 9.—To Dr. Edgar A. Mearns, U. S. Army, International Boundary Commission, El Paso, Tex. A collecting outfit to be used in collecting and preserving natural history specimens for the National Museum. Reference to a portion of the collections received from him will be found in the accession list (section V). Other collections which have been received from him will be referred to in the Museum Report for 1893.

March 9.—To Mr. Louis Dexter, United States consul, Azores. Tank-box, copper tank, alcohol, etc., to be used for collecting and preserving natural history specimens for the National Museum.

March 24.—To Dr. Timothy E. Wilcox, U. S. Army, Fort Huachuca, Ariz. Tank-box, copper tank, alcohol, etc., to be used in collecting and preserving natural history specimens for the National Museum.

March 29.—To Mr. J. H. Camp, Leopoldville, Congo District, Africa. Outfit to be used in obtaining and preserving natural history specimens for the National Museum.

May 16.—To Mr. George P. Merrill, U. S. National Museum. Copper tank, tank-box, and other material necessary to be used in collecting and preserving natural history and other specimens for the National Museum during his explorations in Arizona and adjoining States.

June 2.—To Dr. Edgar A. Mearns, U. S. Army, International Boundary Commission, Deming, N. Mex. Ammunition, cotton and hemp twine, and other articles for use in collecting and preserving natural history and other specimens for the National Museum.

June 11.—To Rev. J. A. Potter, Fort Clark, Tex. Two tank-boxes, alcohol, paper labels, and other material, required in collecting and preserving natural history specimens for the National Museum.

SECTION II.

REPORTS OF THE CURATORS OF THE U. S. NATIONAL MUSEUM UPON THE PROGRESS OF THEIR WORK DURING THE FISCAL YEAR ENDING JUNE 30, 1892.

REPORT ON THE DEPARTMENT OF ETHNOLOGY IN THE U. S. NATIONAL MUSEUM, 1892.

By OTIS T. MASON, *Curator.*

During the fiscal year the entire staff of this department has been engaged in making preparation for the World's Columbian Exposition. The subject of ethnology at Chicago having been placed under the charge of Prof. Putnam, of Cambridge, it was necessary to devise some scheme by which his operations in the general exhibit should be kept separate from that of the Smithsonian Institution in the Government building.

After consideration it was thought best to have the work of the Bureau of Ethnology (which is under the direction of the Smithsonian Institution) and that of the Department of Ethnology united. For the double purpose of this coöperation and of avoiding conflict with the general exhibit, it was very opportune that the work of Maj. Powell, entitled *Indian Linguistic Families of America North of Mexico,* was completed, so that it could be utilized for our purpose. The result of this investigation is that the tribes of North America have been divided into the following linguistic families: Algonquian, Athapascan, Attacapan, Beothukan, Caddoan, Chimakuan, Chimarikan, Chimmesyan, Chinookan, Chitimachan, Chumashan, Coahuiltecan, Copehan, Costanoan, Eskimauan, Esselenian, Iroquoian, Kalapooian, Karankawan, Keresan, Kiowan, Kitunahan, Koluschan, Kulanapan, Kusan, Lutuamian, Mariposan, Moquelumnan, Muskhogean, Natchesan, Palaihnihan, Piman, Pujunan, Quoratean, Salinan, Salishan, Sastean, Shahaptian, Shoshonean, Siouan, Skittagetan, Takilman, Tañoan, Timuquanan, Tonikan, Tonkawan, Uchean, Waiilatpuan, Wakashan, Washoan, Weitspekan, Wishoskan, Yakonan, Yanan, Yukian, Yuman, Zuñian.

Many of these stocks, whatever may have been their previous history, at present include only a few individuals. Indeed a few of them have become extinct, and are known only in the literature of the early explorers and missionaries.

The Chicago Exposition furnishes an excellent opportunity of testing the questions—how far language coördinates itself with industries and activities as a mark of kinship and race, and how far climate and the resources of the earth control the arts and industries of mankind in the sphere of language and race. For the purpose of testing these questions thoroughly, the following stocks have been selected: Algonquian, Athapascan, Eskimauan, Iroquoian, Kiowan, Koluschan, Muskhogean, Piman, Shoshonean, Siouan, and Yuman, in order to emphasize original influences as affecting activities regardless of stock.

Southeastern Alaska and British Columbia were chosen as one region, northern Colorado, Oregon, and Washington as another, southern California and parts adjacent as a third region, and the Pueblo country as a fourth.

The Algonquian family formerly inhabited the southern and eastern drainage of Hudson Bay, Newfoundland, Nova Scotia, the Atlantic slope of the United States as far south as the thirty-fifth parallel, the regions around lakes Michigan, Huron, and Superior, and almost the entire drainage of the Ohio River. This would give an excellent opportunity of studying the effect of twenty-five degrees of latitude and every variety of elevation, access to inland and salt waters, abundance or scarcity of various animal and vegetable productions. The question then in this case would be to find out how far uniformity of activities had been secured over this wide and varied area by the possession of a common language.

The Iroquoian stock occupied the region around lakes Erie and Ontario, and the upper St. Lawrence River. They were also in possession of the Susquehanna drainage, the mountainous region of Tennessee, Kentucky, Virginia, the Carolinas, Georgia, and Alabama, with two small grants on the Atlantic coast, one in southern Virginia, the other in eastern North Carolina.

The territory of the Muskhogean stock was bounded on the west by the Mississippi River, north by the Tennessee River and Cherokee Country, south by the Gulf of Mexico, east by the Atlantic Ocean. This stock was early visited by Spanish, French, and English explorers, and, on account of the advanced civilization of its tribes, has been looked upon as furnishing the best explanation of the mode of life among the Mound Builders.

The Siouan stock may be studied with advantage, on account of its restriction to the country of the buffalo, extending along the Mississippi (and particularly the Missouri), on the plains of the great West, reaching as far north as Saskatchewan River and as far south as the city of Natchez. A narrow strait across the State of Wisconsin, extending to Lake Michigan, was occupied by this stock, and some of the tribes are known to have lived in the mountains of Virginia and North Carolina, above the falls of the rivers running into the Atlantic Ocean. The Biloxis of Louisiana belong also to this stock.

Perhaps the most interesting of all the stocks, as regards geographic distribution and the relationship between tribal organization, language, and activities, is the Athapascan, occupying the drainage of the Yukon River, in Alaska, and the Mackenzie River, in Canada, and extending southward and inland to the upper waters of the Frazer River, in British Columbia. They touch the waters of the Pacific at Cook's Inlet, in Alaska, and on the coast of northern California and southern Oregon. They are also spread out over Arizona, New Mexico, and northern Mexico. The distance between the most northern and most southern members of this stock is over 40 degrees of latitude.

The Eskimauan stock affords an excellent example of a homogeneous people, spread out over many thousands of miles in an eastern and western direction, but always in an arctic or subarctic environment. In this area, however, there is great variety of materials, so that the same apparatus appears in one place, made of walrus ivory, in another of antlers, in another of driftwood, in another of bone. At the lowest points reached by these people may be found implements fashioned from the standing trees. Another source of variety in the production of this stock is the accessibility of the various regions to the whaling industry and other forms of trade. In those places from which the trading vessel has been excluded, the people are living in unchanged simplicity. In other parts where the natives have been in close contact with the whites, as in the Russian domain, the acquisition of better tools has enabled them to improve remarkably upon their own arts, and this may fairly raise the question whether in other parts of North America the arts of the aborigines were not bettered by the coming of the superior race.

The Kiowan stock, so far as we can gain any knowledge of its spread historically, was confined to a very narrow area in Wyoming and Nebraska. The Kiowas are surrounded by Siouan, Shoshonean, and western Algonquian tribes; furthermore, since their home is on the plains of the great West, the buffalo country, their arts may be expected to resemble those of the surrounding peoples.

The Shoshonean stock, joined by Brinton and others with the Piman stock and the Aztecan, is confined chiefly to the Great Interior Basin, with outlying tribes in and across the mountain east and west. In one place, at the Moki villages, we have an example of Shoshoneans living in pueblos; all of the other tribes are dwellers in tents.

The Pueblo country furnishes an excellent example of the mode of architecture and life controlled by the region, and dominating over both language and tribal organization. In the open country among these Pueblos dwell the Apache and Navajo, of Athapascan stock, and late intruders from the north. These two peoples of the same family differ very much in all the arts of life, because the former, refusing to receive flocks from the Spaniards, have continued their course as bloodthirsty savages down to the present moment. On the other hand, the Navajo, accepting flocks of sheep from the Spanish explorers, have learned the value of personal and tribal property, and have changed their mode of life and their industries altogether in accordance with the new state of affairs.

Around the Gulf of California are the Piman and Yuman stocks, and these, owing to their homogeneous environment, furnish better material for the student of comparative ethnology.

In exhibiting material from the Pacific slope, owing to the great variety of stocks crowded in circumscribed areas, the study was made of special regions offering natural conditions. Between Vancouver Island and Mount St. Elias is a vast forest region, the waters abounding in fish. Here are the Koluschan, Chimmessyan, Skittagetan, and Wakashan stocks, and their homogeneous environment enables the ethnologist to study the diversities of tribes and stock, so far as they are expressed in natural things.

The Salishan and Shahaptian stocks together occupy the drainage of the Lower Frazer and Columbia rivers and could easily be considered apart. But from the mouth of Columbia River to the Santa Barbara Islands there is such a confusion of languages that we should hardly expect to find a new set of activities corresponding to each one of them.

The effort was made during the year to set up in proper costume groups of men, women, and children belonging to the largest of these stocks, engaged in some characteristic operation, so as to give to the visitors to the exhibition some idea of how the people would look in their homes. In addition to this, an arrangement was made for a series of alcoves, each one devoted to a separate stock. The objects were to be arranged in these alcoves to show the habitation, industries, and activities of the tribes belonging to the several stocks. Supplementary to this, a series of alcoves was devoted to characteristic arts, and in these the materials, apparatus, and products of each art were arranged upon an ethnographic basis, enabling the beholder to compare tribe with tribe upon the basis of a single industry.

Inasmuch as a large amount of American aboriginal handiwork is made by women, it has been thought advisable to devote one alcove exclusively to woman's work. The object of this is especially to show that the seeds of our modern industrial life were sown by women in savagery. Whether we regard the exploitation of the earth for minerals in the shape of clay for pottery or materials for cooking vessels and cutlery, the gleaning of the fields and forests for plants to be worked up into food and textile, or the manipulation of animal substances of food, shelter, clothing or useful apparatus, the result is the same. It has been decided to exhibit these results in an alcove especially set apart for women's work.

ACCESSIONS.

The following accessions, made during the year, deserve special mention:

As a result of the patent congress, Miss Nellie Long Maynard loaned to the National Museum, through Mr. George W. Maynard, the collection of models and firearms illustrative of the invention of the Maynard rifle. This deposit, in connection with that of Col. Dodge, secures to the Museum a most creditable series of breechloading firearms.

From the Cocopa, Yaki, Yuma, Papago, and other tribes of Sonora, Mexico, and Lower California, Mr. Edward Palmer collected for the Museum objects illustrating the industries of these tribes. The specimens in this collection are of the greatest value because they were selected in order to illustrate the humble industries of these tribes.

The Icelandic Natural History Society made a contribution of clothing and household utensils from that island.

The musical instruments of the Samoan Islands were contributed by Hon. Howard M. Sewall.

From Torres Straits Mr. A. C. Haddon sent a collection of eighty-three pieces illustrating the arts and life of the natives of that region. They are especially interesting on account of the contact at this point between the Papuan and Australians.

Capt. J. O. Spicer, of Groton, Conn., has added one more to the many obligations under which the Museum has been brought by his generosity in giving specimens of Eskimo clothing from Hudson Bay.

Hon. Alex. R. Webb, consul to the Phillippine Islands, collected apparatus for games and gambling.

The collection of 372 pieces of Mr. James Mooney from Kiowa, Cheyenne, and Arapaho, Comanche, Sioux, and Wichita Indians was made with a view to illustrating the life of these tribes at the Chicago Exposition. Therefore they are of special value for ethnographic study.

Capt. John G. Bourke continued to manifest his interest in the Museum and sent from Mexico objects of very great value.

Dr. W. J. Hoffman, for the Bureau of Ethnology, made a collection among the Ojibwa and Menomonee Indians.

Mr. R. W. Bartleman, United States legation, Carácas, Venezuela, has taken a special interest in the National Museum, and sent valuable material from that country.

Mr. Emile Granier contributed costumes and industrial implements from the Arapahos and Shoshones.

The Museum was very fortunate to secure from the Royal Zoölogical Museum, Florence, through Mr. H. H. Giglioli, ethnological specimens from New Guinea, Andaman Islands, and from several groups in the Molgave and Melanesian area.

Miss Anna Picher, of Pasadena, Cal., contributed specimens of Mexican handiwork.

Dr. Z. T. Daniel, U. S. Army, continued to favor the Museum with specimens from Dakota.

Mr. S. G. Worth, U. S. Fish Commission, contributed apparatus to illustrate the turpentine industry of North Carolina.

Mr. Fred. A. Ober sent from various islands of the West Indies rude appliances in vogue among the more ignorant peoples.

Lieut. George Emmons, U. S. Navy, sent to the Museum a number of bracelets of great value from Sitka.

Through Hon. Rounsevelle Wildman, United States consul at Singapore, the Museum received a small number of weapons and apparatus for gaming.

Dr. Washington Matthews made a collection of Navajo wools and the material used in dyeing them.

Dr. W. H. Dall gave to the Museum collections made in India by his father, Rev. C. H. Dall.

The Museum is greatly indebted to Mr. I. C. Russell for 171 specimens collected during his exploration of interior Alaska.

Dr. C. E. Woodruff, U. S. Army, contributed 37 photos of Hupa Indians in California.

From Mr. H. R. Thornton the Museum secured a complete suit of armor made in imitation of that of Japan from plate of walrus ivory.

A collection of ethnological objects from the Montagnais Indians of Labrador was presented by Mr. Henry G. Grant.

Lieut. G. B. Harber, U. S. Navy, presented a costly and beautiful series of fine clothing from the Yokut of North Siberia. Additional value is given this collection by the fact that these costumes were worn by Lieut. Harber and members of his party during the Jeannette relief expedition.

Dr. J. Walter Fewkes presented to the Museum illustrations of Moki dances and rendered good service in labeling many of the specimens collected already in the Museum from ancient Tusayan.

Dr. Franz Boas brought from the Chinuk tribes of Washington Territory a small collection.

From Capt. R. H. Pratt, U. S. Army, the Museum has received a large collection from various Indian tribes represented by the children at Carlisle school.

From Mr. Charles de Struve the Museum received 39 portraits of the people of Russia.

Mr. John Murdoch gave a small collection of Eskimo clothing personally made by him at Point Barrow, Alaska.

The Museum received a great many favors from Mr. Stuart Culin, of Philadelphia, who has familiarized himself with the games of the Chinese.

Mr. J. H. Turner, of the U. S. Coast Survey, gave the Museum 277 specimens collected on the boundary line between Alaska and Canada.

Dr. R. H. Lamborn, of Philadelphia, has loaned to the Museum a collection of Galton's anthropometric apparatus.

Mr. Edward Lovett, of Croydon, England, has continued to enrich the Museum with specimens from the East.

ROUTINE WORK.

The routine work of the department of ethnology during the fiscal year was greatly aided by the construction of a large cabinet for the study series of objects and the setting apart of a special room for specimens too large for the ordinary cabinet. Owing to the lack of space it will be impossible in the future to increase the number of objects on exhibition at any one time. To meet the difficulty, and also to prepare for any additional space which may be granted in the future to this department, the curator has continued to mount and label new specimens in standard unit boxes. The boxes compare in size to the standard Museum drawers, viz: 30 inches in length by 24 inches in width, and of any depth to suit specimens from 2 to 12 inches. When once the specimens are mounted and labeled and sealed up in these exhibition boxes, these may be filed away on shelves or racks like books in a library.

The curator has had a large number of drawings made and has prepared the library material for a monograph on the arts of war among the North American aborigines. Mr. Walter Hough has bestowed a great deal of care on the preparation of a catalogue of the Korean collection,* which has been brought together through the coöperation of

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* See Report of U. S. National Museum, 1891, pp. 429–488.

Dr. Allen, Ensign Bernadou, U. S. N., Mr. P. L. Jouy, and others interested in the work of the National Museum.

In conclusion the curator most earnestly hopes that in future more ample accommodations may be furnished for the exhibition of the ethnological collections. The object of all such exhibits should be the education of the people in the history of culture, but a comprehensive and correct idea of human progress can be given only where there is sufficient room to tell the whole story without crowding.

The first catalogue entry in July, 1891, was 152651, and the last entry in June, 1892, was 153894, giving a total of 1,243 entries.

The number of specimens received during the year is 2,241.

REPORT ON THE DEPARTMENT OF AMERICAN ABORIGINAL POTTERY IN THE U. S. NATIONAL MUSEUM, 1892.

By WILLIAM H. HOLMES, *Honorary Curator.*

The operations in this department have been chiefly confined to the instalment of a large number of collections, none of which are of especial importance. These collections consisted for the most part of fragmentary wares collected for the Bureau of Ethnology by the curator and his assistants in the tide-water districts of Maryland and Virginia, and in the Gila valley, Arizona.

During the year the curator completed an elaborate paper upon the pottery of the mound-builders, to be published by the Bureau of Ethnology. Two papers upon aboriginal decorative art, derived from ceramic sources, were published in the "American Anthropologist," one in the January and the other in the April number.

The last catalogue number for June, 1891, is 136183; and for June, 1892, 155306.

Donations of earthenware were made by the following persons: Mr. Samuel A. L. Queredo presented fragments of painted pottery from the Argentine Republic, South America. Mr. W. Hallet Phillips transmitted fragments of vases from Ossabaw Island, Georgia. Mr. William Harden contributed a large earthen vessel from Ossabaw Island, Georgia. Prof. G. K. Gilbert, of the U. S. Geological Survey, presented fragments of ancient pueblo ware from Arizona. Mr. Henry Adams sent fragments of pottery from St. Helena Island, Georgia. Capt. John G. Bourke, U. S. Army, transmitted earthen vessels from Guadalajara, Mexico. Mr. Arthur H. Weston gave fragments of pottery from Florida. Thomas Dowling, jr., contributed fragments of pottery from Montgomery County, Md. From Mr. E. S. Golson were received fragments of pottery from Saginaw River, Michigan.

REPORT ON THE SECTION OF ORIENTAL ANTIQUITIES IN THE U. S. NATIONAL MUSEUM, 1892.

By CYRUS ADLER, *Assistant Curator.*

In the absence in Europe of Prof. Paul Haupt, honorary curator of the section, I beg to submit the following report for the past year:

The scope of an oriental department fully organized may be seen from the division into sections which was adopted by a committee of the American Oriental Society, organized for the purpose of drawing up a programme to be submitted in the event of the assembling of an International Congress of Orientalists in America. The sections were as follows:

I. Aryan section. II. Semitic section (Hebrew, Arabic, Syriac, etc.). III. Cuneiform section, including all languages using cuneiform characters. IV. Egyptian section, comprising the other African languages with the exception of Ethiopic and Arabic. V. Section of the extreme Orient (China and Japan) and of Central Asia.

The Section of Oriental Antiquities, in view of the limitations upon its scope and resources, is practically devoted to Biblical archæology, to the archæology, history, languages, arts, and religions of the peoples of western Asia and Egypt. Material is chosen which especially illustrates Biblical history, and labels are prepared from this point of view.

The fact must be emphasized that before the organization of this section was contemplated, much of the material which would find place in a department of oriental antiquities had been collected for the Museum and installed in other departments, where it still remains.

In the report for 1889 the hope was expressed that from the policy inaugurated by the Museum of preparing copies of Assyro-Babylonian objects for a study collection, there would grow a catalogue of all the Assyro-Babylonian objects in this country. This plan, it is expected, may shortly be realized. At the meeting of the American Oriental

Society held in Washington in April, 1892, the following resolution was adopted:

> In view of the introduction into this country of numerous collections of oriental antiquities, especially from Egypt, Assyria, and Babylonia,
>
> *Resolved I.* That the Oriental Society recommends that records be obtained of such objects, in both public and private collections;
>
> *Resolved II.* That a committee of three be appointed by the president to aid in securing such material.

The assistant curator was appointed a member of this committee.

The American Oriental Society held its annual meeting in the chapel of the Smithsonian Institution, April 21–23. A portion of the Hodgson collection of oriental MSS., and of photographs of Assyrian objects and of paper impressions of Egyptian sculpture, was temporarily placed on exhibition in the chapel during the meeting.

Mr. Frederick Stearns has offered to place his collection of Babylonian cylinders and other oriental objects of glyptic art at the disposal of the Museum for copy.

The honorary curator, Prof. Paul Haupt, left for Europe in the month of May. He will attend the Ninth International Congress of Orientalists at London as the delegate of the Smithsonian Institution.

The assistant curator returned from his absence in the Orient in the interest of the World's Columbian Exposition in the month of January, and resumed his connection with the Museum on March 1. Much of his time has been given to the formation of a collection of religious ceremonials for the exhibit of the National Museum at the Columbian Exposition.

Two very carefully made and well-preserved paper molds of a piece of sculpture and a cuneiform inscription from Persepolis have been received, through the Department of State, from the Honorable Truxton Beale, United States minister at Teheran. Casts have been made from these molds and their contents will be described in a special paper.

Mr. Beale had secured permission from the Persian Government to remove some objects from Persepolis. On arriving at the spot he concluded that nothing characteristic could be removed without grossly disfiguring the ruins. He found also that Mr. Herbert Weld Blundell had already commenced to make copies for the British Museum, but was quite willing that the National Museum should coöperate in the work. These two moldings, the first made, were presented by Mr. Blundell to Mr. Beale. It appears that the mold of the cuneiform inscription is the first ever taken from Persepolis. It is to be hoped that means will be found to prosecute this important archæological undertaking.

The Museum has received on deposit from the Telfair Academy of Arts and Sciences, of Savannah, Ga., a portion of the collection of oriental books and manuscripts of the late William B. Hodgson. Mr. Carl L. Brandt, director of the Telfair Academy, is entitled to hearty recognition for his assistance in securing the deposit of this interesting collection.

The crowded state of the Museum has rendered it impossible to place any more objects in the exhibition series.

Two papers, relating to the Hodgson collection, were read by Dr. Adler before the American Oriental Society at the meeting held in Washington: "Notes on William B. Hodgson" and "Christopher Columbus in oriental literature with special reference to a Turkish MS."

The catalogue of the section is kept by the department of ethnology.

REPORT ON THE HISTORICAL COLLECTIONS IN THE U. S. NATIONAL MUSEUM, 1892.

A. HOWARD CLARK, *Curator.*

The curator of historical collections, being also editor of the Proceedings and Bulletin, and in charge of the printing of labels and blanks for all departments of the Museum, has been unable to give as much attention as desired to the general work on the very valuable collection of objects classified as "historical relics," and which are of very great interest to the numerous visitors to the National Museum.

An effort has been made to place on exhibition relics or memorials that may teach biography or American history in an intelligent manner, rather than to exhibit objects that are simply "curios," bearing no special relation to eminent men or important events.

Being without the aid of an experienced assistant, the curator is unable to report much technical work accomplished in the study and arrangement of the hundreds of medals and coins that have accumulated. In fact, the incomplete condition of several classes of objects on exhibition, as regards proper labeling and installation, has necessitated the temporary withdrawal of some of the most interesting collections.

For exhibition at the Columbian Historical Exposition at Madrid in the summer and fall of 1892, the curator brought together quite a full series of American colonial coins; medals illustrating the colonial period, the Revolutionary War, and medals commemorative of political and civic events, besides a large series of paper money, extending from the early days of the American colonies down to the present national currency; also postage stamps of each issue since 1847, when they were introduced in this country; maps of early explorers, engravings of important national events, etc.

The character of the historical collections in the National Museum was outlined in the curator's report for the last fiscal year, and an effort has been made to carry out the plan therein set forth. Some valuable additions have been made to the collections. The number of accessions has been thirty-three, aggregating several hundreds of individual objects. Among the important accessions were the cabinet of ancient and modern gold, silver, and copper coins, antique seals, etc., bequeathed by Gen. Meigs; the Cox memorial vase from Mrs. S. S. Cox; the Sèvres vase presented to Prof. Hilgard, some autograph papers by President Adams and William Henry Harrison, the original roll and muster of Gen. Washington's body-guard in 1782, a dish and ewer of precious metals presented to Admiral Jouett, and a complete collection of photographic and engraved portraits and autograph letters of members of the National Academy of Sciences.

The curator has been called upon to examine and report on ten collections of coins, medals, and historic objects, which have been returned to the owners.

ACCESSIONS DURING THE YEAR ENDING JUNE 30, 1892.

A. F. Wooster, Norfolk, Conn. Haytien copper coin. (Acc. 24529.)

Dr. Clarence W. Bowen, New York City. Programmes, circulars, invitations, cards, and other official papers relating to the centennial celebration of Washington's inauguration in New York City, April 30, 1789–1889. (Acc. 24551.)

Weil Brothers, Alexandria, Va. Spanish coin of the year 1781. (Acc. 24599.)

T. G. Fillette, U. S. Navy, Washington City. Cane of palm wood, the handle a wild boar's tusk, gold mounted, presented to Lieut. Fillette by His Majesty Kalakaua, King of the Hawaiian Islands. (Acc. 24660.)

Wm. V. Kramer, Washington City. Copper coin, 2½ cent, of Dutch East Indies, 1858, and copper coin, 1 cent, of British North Borneo Company. (Acc. 24661.)

Paul Beckwith, Washington City. Photograph from pencil sketch (made by Col. Réné Paul) of first residence built in the city of St. Louis, Mo., February 10, 1764. (Acc. 24724.)

John F. Kelly, Washington City. Police baton carried by the auxiliary guard, a night police force of Washington, D. C., prior to 1861. (Acc. 24817.)

Paul Beckwith, Washington City. Jubilee medal of Pope Leo XIII, issued on the fiftieth anniversary of his episcopacy. (Acc. 24834.)

James J. Clark, Troy, N. Y. Small box made from portion of tree in Scotland under which Sir William Wallace hid himself in the XIIIth century. (Acc. 24883.)

George E. Muzzey, Lexington, Mass. Silver medal of the centennial celebration of the battle of Lexington, April 19, 1775–1875. (Acc. 24958.)

B. H. Hall, Washington City. The Kearney cross, bronze, Birney's Division, one of the thousand decorations given by Gen. Birney, in 1862–'63, to soldiers under his command for bravery. (Acc. 24966.)

Mrs. W. N. Callender, Greenbush, N. Y. Hand-made shingle from original portion of Van Rensselaer house, built in 1642. (Acc. 24967.)

Henry Sandham, Boston, Mass. Gravure etching proof of the reproduction of oil painting, Battle of Lexington (original by Mr. Sandham), in town hall at Lexington, Mass. (Acc. 25018.)

W. N. Callender, Greenbush, N. Y. Stone porthole from the Van Rensselaer mansion, built at Greenbush in 1642. (Acc. 25051.)

B. T. Nash, Syracuse, N. Y. Cap worn by Nathan Ives during naval engagement between the *Kearsarge* and the *Alabama;* also knife sheath and sailor's palm owned by Seaman Ives. (Acc. 25148.)

Mrs. J. E. Hilgard, Washington City. Sèvres vase presented to Prof. Hilgard by the French Government. (Acc. 25172.)

Joseph Francis, Minneapolis, Minn. Silver medal presented to Mr. Francis on occasion of a celebration on Lake Lucerne.

Gen. M. C. Meigs, U. S. Army. Seven water-color sketches of views in Washington City.

Executors of estate of Gen. M. C. Meigs, U. S. Army. Antique seal ring with intaglio portrait of Julius Cæsar, signet ring of bronze with stone engraved intaglio, cabinet of ancient and modern gold, silver, and copper coins, medals, etc.; silver tureen presented to Gen. Meigs by citizens of Washington; silver tea-kettle presented to Commodore Rodgers by citizens of Baltimore for saving the city from British capture during war of 1812-'15, and other objects bequeathed by Gen. Meigs to the National Museum. (Acc. 25386.) Also, large collection of maps, architectural, engineering, and monumental engravings, photographs, scrapbooks, etc., collected by Gen. Meigs.

Mrs. S. S. Cox, New York City. Memorial vase presented to Mrs. Cox by the members of the Life-Saving Service of the United States in commemoration of the services of the late Hon. S. S. Cox.

Mrs. Charles L. Brace, Dobbs Ferry, N. Y. Silver medal presented in 1877 by King Victor Emmanuel to the late Charles L. Brace for his labors among the Italian children in New York City. (Acc. 25476.)

A. F. Wooster, Norfolk, Conn. French copper coin. (Acc. 25485.)

J. H. McCreery, Oceanport, N. J. Portion of foundation of Quaker Church, built in 1727 in Burlington County, N. J. (Acc. 25543.)

Mrs. Matthias Denman Wilbur, Newark, N. J. Military land patent signed by John Adams, President of the United States, and dated at Philadelphia, March 28, 1800, granting 4,000 acres in Northwest Territory to Matthias Denman. (Acc. 25551.)

Miss Charlotte D. Wilbur, Newark, N. J. Autograph receipt from William Henry Harrison, clerk of the Northwest Territory, to Matthias Denman, dated May 21, 1800, indorsed by John Cleves Symmes. (Acc. 25552.)

Mrs. Theodore W. Parmele, New York City. Historical chart of the United States. (Acc. 25558.)

Romyn Hitchcock, Washington City. Six copies of the Peking Gazette, the oldest newspaper in the world, published daily in Peking, China. (Acc. 25569.)

John C. Bird, St. Louis, Mo. Flint-lock, breech-loading musket, with silver plate inscribed: "By resolve of Congress presented to Gustavus A. Bird for gallantry at battle of Plattsburgh." (Acc. 25598.)

Capt. James M. Miller, Washington City. Original roll and muster of the Commander-in-Chief's (Gen. Washington's) Guard for the month of July, 1782, certified by Wm. Colfax, Lieutenant in command; also testimonial to good service and character of de Arendt. (Acc. 25672.)

Admiral J. E. Jouett, U. S. Navy, and Mrs. Jouett, Washington City. Dish and ewer of "precious metals," presented to Admiral Jouett for services in saving from shipwreck the British steamship *Historian* in the Caribbean Sea in 1885. (Acc. 25679.)

R. W. Turner, U. S. consul at Cadiz, Spain. Wooden door formerly used in the convent of La Rabida at Palos, Spain. (Acc. 25681.)

Mrs. James C. Booth, Haverford, Pa. Platinotype portrait of Prof. James C. Booth, Ph. D., LL. D., late melter and refiner of the United States mint at Philadelphia. (Acc. 25785.)

Dr. Marcus Benjamin, New York City. Complete collection of photographic or engraved portraits, and autograph letters of members of the National Academy of Science.

AMERICAN HISTORICAL ASSOCIATION.

As in previous years, the annual meeting of the American Historical Association was held in the lecture hall of the National Museum during the Christmas holidays, when the curator of historical collections prepared a special exhibit of documents and relics pertaining to American history.

Under the act of incorporation the association deposits its collections in the National Museum. During this fiscal year there have been received for storage several thousand volumes and pamphlets published by the association since its organization in 1884, besides a considerable number of books and pamphlets presented to the association and forming the nucleus of a historical library.

The programme of the annual meeting held December 29-31, 1891, was as follows:

Inaugural Address. By Hon. William Wirt Henry, of Richmond, Va., President of the association.

The Virginia Secession Movement. The Convention of 1861. By Dr. Jeffrey R. Brackett, of Baltimore.

A Few Facts from the Records of an Old Virginia County. By President Lyon G. Tyler, of William and Mary College

The Earliest Texas. By Mrs. Lee C. Harby, of New York City.

Henry Clay, the First Political Speaker of the House. By Miss Mary Parker Follett, Harvard "Annex."

Gov. William Leete and the Absorption of New Haven Colony by Connecticut. By Dr. B. C. Steiner, Williams College, Massachusetts.

Lord Lovelace. By Gen. James Grant Wilson, president, New York Genealogical and Biographical Society.

Once Famous Louisbourg and Memorials of the French Régime in Cape Breton. By J. G. Bourinot, C. M. G., LL. D., D. C. L., Ottawa, Canada.

Enforcement of the Slave Trade Laws. By W. E. B. Du Bois, A. M., Rogers Memorial Fellow, Harvard University.

Lotteries in American History. By Hon. A. R. Spofford, Librarian of Congress, Washington, D. C.

Some Characteristics of Boston Puritans. By Prof. Barrett Wendell, of Harvard University.

Parliamentary Government in Canada. By J. G. Bourinot, C. M. G., LL. D., D. C. L., Ottawa, Canada.

Slavery in the Territories, Historically Considered. By President James C. Welling, of the Columbian University, Washington, D. C.

Historic Portraits of Benjamin Franklin. Illustrated. By Clarence Winthrop Bowen, Ph. D., New York.

The History of the Irish Land Legislation. By Prof. William A. Dunning, of Columbia College, New York City.

Phenomena of Universal Suffrage. By Brooks Adams, Quincy, Mass.

The Treaty-Making Power under the Constitution. By Judge Charles B. Elliott, Ph. D., Law School, University of Minnesota, Minneapolis.

The United States and International Arbitrations. By Prof. John Bassett Moore, of Columbia College, New York City.

Visitorial Statutes of Andover Seminary. By Prof. Simeon E. Baldwin, law department, Yale University.

State Sovereignty in Wisconsin. By Albert H. Sanford,, B. L. of the University of Wisconsin. (To be read by Prof. C. H. Haskins.)

Commerce and Industry of Florence during the Renaissance. By Dr. Walter B. Scaife, Pittsburg, Pa.

The Present Status of the Subject of pre-Columbian Discovery by the Norsemen. By James Phinney Baxter, esq., Portland, Me.

The History and Determination of the Line of Demarcation established by Pope Alexander VI between the Spanish and Portuguese Fields of Discovery and Colonization. By Prof. Edward G. Bourne, Adelbert College, Cleveland.

Recent Discoveries concerning Columbus. By President C. K. Adams, of Cornell University.

The Annual Report of the Association for 1890 was transmitted to Congress by the Secretary of the Smithsonian Institution in February, 1891, but was not printed until the present fiscal year. It is an octavo volume of 310 pages, the contents being as follows:

Report of proceedings at seventh annual meeting, held in Washington, D. C., December 29–31, 1890.

Inaugural address of John Jay, president of the association: The Demand for Education in American History.

I.—CANADIAN HISTORY.

Canada and the United States from Historical Points of View. By J. G. Bourinot.

New England Settlements in Acadia. By Benjamin Rand.

The Legislative Work of the First Parliament of Upper Canada. By William Houston.

II.—EUROPEAN HISTORY.

The Fate of Dietrich Flade. By Prof. George L. Burr.

Theory of Village Community. By Dr. Charles M. Andrews.

A Plea for Reform in the Study of Municipal History. By Dr. George Gross.

Mirabeau's Speech of May 20. By Freeman M. Fling.

The Formation of the French Constitution. By Adolphe Cohn.

Karl Follen and the Liberal Movement in Germany. By Prof. Kuno Francke.

Bismarck the Typical German. By William G. Taylor.

III.—AMERICAN CONSTITUTIONAL HISTORY.

How the Written Ballot came into the United States. By Douglass Campbell.

A Virginia Bill of Attainder, the Case of Josiah Phillips. By Prof. William P. Trent.

Amendments to the Constitution of the United States. By Herman V. Ames.

Congressional Demands upon the Executive for Information. By E. C. Mason.

Responsible Government in Canada. By J. G. Bourinot.

Bills of Rights in State Constitutions. By Gen. R. D. Mussey.

IV.—AMERICAN ECONOMIC HISTORY.

The Historical Development of the Budget of the United States. By Ephraim D. Adams.

The Yazoo Land Companies. By Dr. Charles H. Haskins.

State Articles and Politics. By William F. Willoughby.

Slavery in New York. By Edwin Vernon Morgan.

Slavery in the District of Columbia. By Mary Tremain.

Remarks by William Birney on Miss Tremain's paper, "Slavery in the District of Columbia."

V.—AMERICAN HISTORY—HISTORICAL SCIENCE.

Raleigh's Settlements on Roanoke Island. By Dr. Stephen B. Weeks.

The Political Ideas of the Puritans. By Dr. Herbert L. Osgood.

State Historical Societies. By Gen. C. W. Darling.

Organization of Historical Material. By W. H. Mace.

Is History a Science? By Prof. R. H. Dabney.

Webster's Seventh of March Speech. By James Schouler.

The Borderland between the Historian and the Archæologist. By Prof. Otis T. Mason.

Bibliography of the Writings of the Members of the American Historical Association for 1890. By Paul Leicester Ford and A. Howard Clark.

Supplementary Bibliography of the Writings of Members of the American Historical Association. By Paul Leicester Ford and A. Howard Clark.

Bibliography of the Historical Societies of the United States. By A. P. C. Griffin. Part I.

REPORT ON THE SECTION OF GRAPHIC ARTS IN THE U. S. NATIONAL MUSEUM, 1892.

By S. R. KOEHLER, *Curator*.

Repeating the words of my report for last year, it may be said that the work done in the section of graphic arts during the fiscal year just ended, does not show perceptibly in the appearance of the collections exhibited. The aim has again been to make the several divisions more complete by filling gaps here and there, and these additions are, as a matter of course, lost in the mass to the general observer. From the following details it will appear that the endeavor to complete the illustration of the modern photo-mechanical processes has been continued, while at the same time due attention has been given to the other departments, so far as the means at command would allow.

The most important additions of the year are the illustrations of the half-tone relief screen process and of a variety of the photo-aquatint intaglio process (Photogravure Gilbo), prepared for the Museum at reduced prices by Mr. M. Wolfe, of Dayton, Ohio, and Messrs. A. W. Elson & Co., of Boston, Mass., respectively. Some interesting specimens, illustrating the advances made in chromocollographic process work, have been given by Mr. E. Bierstadt, of New York, and the J. B. Lippincott Company, of Philadelphia. The collection of materials used in the photo-mechanical processes has been increased by gifts from Messrs. Jas. P. Smith & Co., of New York, and by purchase. A beginning towards the illustration of the application of chromolithography and of wood-cutting to the production of posters—a kind of work which has reached a high order of merit in the United States—has been made by the gift of a few specimens by the A. S. Seer Theatrical Printing Company, of New York; the Courier Lithographing Company, of Buffalo, N. Y., and Messrs. W. J. Morgan & Co., of Cleveland, Ohio, and by the purchase of some of the tools used. The following additions to the illustrations of the history of the reproductive arts have been made by purchase: Head of Christ, P. 192, woodcut after Dürer; Portrait of Otto Heinrich von Schwarzenberg, woodcut, dated 1607, by Chr. van Sichem, after Goltzius; Christ before Annas, B 12, engraving on copper by Israel van Meckenem; Portrait of Philip II, engraving on copper, dated 1586, by Hieronymus Wierix; Portrait

REPORT ON THE SECTION OF FORESTRY IN THE U. S. NATIONAL MUSEUM, 1892.

By Dr. B. E. Fernow, *Honorary Curator.*

The forestry collections have remained without many additions, owing to the fact that lack of space limits their exhibition, and the bulkiness of the material makes it undesirable to add to them in the storage-rooms.

Since the Museum does not, like the Kew Gardens, command any grounds of its own for the exhibition of living specimens, and the city parks of Washington afford ample opportunity to serve as an arboretum, the curator of forestry collections has prepared during the year a full list, with notes, of all the tree species found in these parks, and plotted the same so that they may be readily found. This compilation, carried on at the expense of the Museum, will be ready for publication next year.

REPORT ON THE SECTION OF TRANSPORTATION AND ENGINEERING IN THE U. S. NATIONAL MUSEUM, 1892.

By J. ELFRETH WATKINS, *Curator.*

During the fiscal year ending June 30, 1892, the time of the curator was largely taken up by assignment to other duties; hence little attention could be devoted to the section.

Unfortunately for the student of the history of the American steamboat and railway, little thought was given in the early days to the preservation of objects which would now be considered invaluable relics of the early stages of the development of these appliances of transportation upon water and land.

So far as is known, the important relics now in existence, with very few exceptions, have been deposited in the U. S. National Museum through the coöperation of the officials of railway and steamboat companies. The future additions to the transportation collection must, therefore, necessarily consist of models and drawings of historic objects. Since the appropriations by Congress did not permit of their construction or purchase, extension of the collection during the year has been made by the acquisition of such objects relating to the development of the mechanic arts as illustrate the evolution of the epoch-making inventions.

During the year the curator took part in the meetings* of the American Association for the Advancement of Science, at Washington; the convention of the Old-Time Telegraphers' Association, at Washington, and the ceremonies at the completion of the monument erected by the Pennsylvania Railroad Company at Bordentown, N. J.

The erection of this monument (Plate I) by the Pennsylvania Railroad Company, to mark the first piece of iron railway track laid between New York and Philadelphia in 1831, attracted the attention of officials and employés of the railway companies throughout this country, and the general public as well, and a description thereof found place in the principal railroad journals of Europe and America. A description of the monument from the memorial volume issued at the time is given below:

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*See Bibliography (Section IV.)

> The railroad monument at Bordentown, erected by the Pennsylvania Railroad Company, was completed in 1891. It is composed of a cube of Baltimore granite, 5 feet square and 7 feet high, supported upon an octagonal foundation composed of the stone blocks upon which the iron rails were originally laid in the tracks of the Camden and Amboy Railroad. Around this cube is a circle composed of two of the original rails with which the road was first laid. These rails are supported by stone blocks according to the original practice, the spikes and joint fixtures also being from the original tracks. This type of rails, which is now known throughout the world as the "American rail," was designed by Robert L. Stevens in 1831. Sunk in the south side of the granite block is a bronze tablet, which contains a representation (carefully drawn to scale), in relief, of the locomotive "John Bull," with tender improvised from a freight truck, with tank consisting of a whisky hogshead, and the two passenger cars that first did service in the State of New Jersey in 1831.

The tablet (Plate II) contains the following inscription in raised letters:

"FIRST MOVEMENT BY STEAM ON A RAILROAD IN THE STATE OF NEW JERSEY, NOVEMBER 12, 1831, BY THE ORIGINAL LOCOMOTIVE 'JOHN BULL,' NOW DEPOSITED IN THE UNITED STATES NATIONAL MUSEUM AT WASHINGTON. THE FIRST PIECE OF RAILROAD TRACK IN NEW JERSEY WAS LAID BY THE CAMDEN AND AMBOY RAILROAD COMPANY BETWEEN THIS POINT AND THE STONE, THIRTY-FIVE HUNDRED FEET EASTWARD, IN 1831."

Upon the east side of the block, cut into the granite are the words:

"CAMDEN AND AMBOY RAILROAD, 1831,"

and on the reverse side is inscribed:

"ERECTED BY THE PENNSYLVANIA RAILROAD COMPANY, 1891."

The programme of the exercises at the celebration of the sixtieth anniversary of the first movement by steam in the State of New Jersey, which was held at Bordentown, November 12, 1891, was as follows:

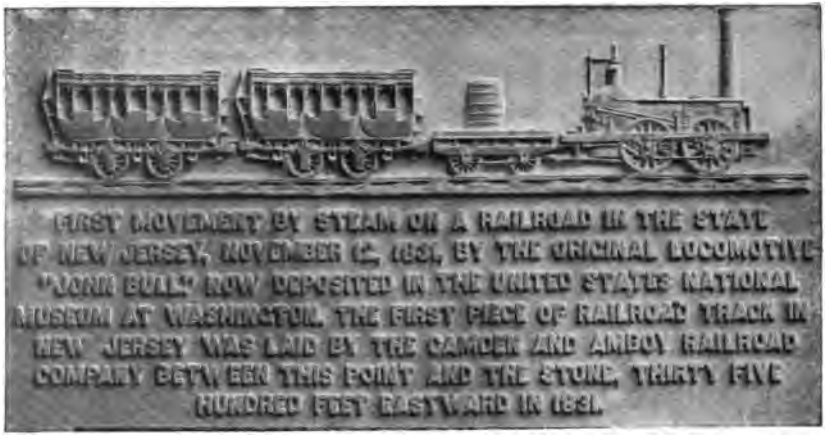
Address of presentation, by Joseph T. Richards, assistant chief engineer, Pennsylvania Railroad Company.

Address of acceptance, by F. Wolcott Jackson, general superintendent, United Railroads of New Jersey Division, Pennsylvania Railroad Company.

Historical address: The Camden and Amboy Railroad—origin and early history—by J. Elfreth Watkins, curator, section of transportation and engineering, U. S. National Museum, Smithsonian Institution, Washington.

The Pennsylvania Railroad Company has since published the addresses delivered at the celebration in a memorial volume, handsomely illustrated.

Interest in the department of transportation at the World's Columbian Exposition has led to frequent examinations of the collection during the year, the objects both in the exhibition and study series being studied by officials of the Exposition and of several railroad companies who propose to take part therein. The chief of the department of transportation-exhibits of the Columbian Exposition spent several


FIRST MOVEMENT BY STEAM ON A RAILROAD IN THE STATE
OF NEW JERSEY, NOVEMBER 12, 1831, BY THE ORIGINAL LOCOMOTIVE
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COMPANY BETWEEN THIS POINT AND THE STONE, THIRTY FIVE
HUNDRED FEET EASTWARD IN 1831.

BRONZE TABLET ON THE RAILROAD MONUMENT AT BORDENTOWN, N. J.
(Cast by John Williams, New York City. Model by Theodore A. Mills, Washington, D. C.)

days in the Museum, in August, 1891, where he studied the collections and had access to a provisional outline of a proposed exhibit, which had been prepared by the curator at the request of the assistant secretary of the Smithsonian Institution, to be used if it were decided that the section of transportation and engineering should be represented in the Government exhibit at Chicago.

With the return of this scheme of classification the following communication was received:

[Department transportation exhibits—railways, vessels, vehicles—Willard A. Smith, chief.]

OFFICE OF THE DIRECTOR-GENERAL,
WORLD'S COLUMBIAN EXPOSITION,
Chicago, Ill., U. S. A., August 27, 1891.

DEAR SIR: I return herewith a scheme of a transportation exhibit, which you kindly loaned to me, and which promises to be of much value. I am greatly obliged to you for the favor, as also for the other literature which you kindly gave me. It will save a great deal of research which would otherwise have been necessary.

Yours truly,

WILLARD A. SMITH.

Prof. J. E. WATKINS,
National Museum, Washington, D. C.

Access to the study and exhibition series in the section was also given to Maj. J. G. Pangborn, special agent in charge of the Baltimore and Ohio Railroad Company's historical exhibit at the World's Columbian Exposition. Numerous photographs of models and drawings in the collection were made by Maj. Pangborn's representative for this exhibit, which promises to be more elaborate than ever before made at an exposition by a railroad company.

At the request of the chief clerk of the Post-Office Department a number of models and drawings in the collection were photographed to form the basis of illustrations for a publication which is designed to show the growth of the United States Post-Office Department.

Among the important accessions during the year are the following:

Electrical locomotive, which made the most rapid recorded speed (115 to 120 miles per hour) on land, by generated power, at Laurel, Md., in the year 1889. Publicly reported by O. T. Crosby in his paper entitled High Speed Electrical Works, and by J. Dashiell, jr., in the Electrical Railway as Applied to Steam Roads. Both papers are to be found in the proceedings of the American Association of Mechanical Engineers.

The following letter accompanied this most interesting piece of machinery:

NEW YORK, *June 13, 1890.*

MY DEAR SIR: According to your request I make the following statement: My electric motor was originated and designed by me for rapid speed. I had in view the enlargement of the same to supplant the steam engine on standard railroads for long-distance service.

It was the first electric motor which was successfully run with the armatures wound directly around the axles, thereby doing away with all wearing parts except the journals, and admitting of any speed desirable.

My motor was run near Laurel, Md., on a circular track, 2 miles in circumference, constructed especially for making these experiments, which extended over a period of nearly two years, during which time speeds were made from 100 to 120 miles per hour. Twenty miles per hour was the fastest speed made by any other electrical motor until mine had made 100 miles per hour.

Yours very truly,

DAVID G. WEEMS.

Prof. J. E. WATKINS,
Washington, D. C.

The following certificate is attached to the locomotive:

On December 3, 1889, I witnessed Mr. Weems' electric motor make a speed of from 115 to 120 miles per hour. I was employed by Mr. Weems as mechanical engineer for about two years, and assisted in a number of test trials of speed made with the motor, and also assisted at the time the above fast rate speed of 115 to 120 miles was made.

B. J. DASHIELL, JR.

The collection has been greatly enriched by the addition of the series of models, tem-plates, and drawings of the various sections of rails, which were considered by "the committee on form, weight, manufacture, and life of rails," appointed by the American Society of Civil Engineers in 1873, and whose deliberations have had an important bearing upon the American rail standards for the last twenty years. This series, which is a most valuable one, was presented by Mr. Octave Chanute, past president, American Society of Civil Engineers, who was an active member of the committee during all its deliberations.

A series of models of steel railroad cross-ties used in Europe was deposited by Dr. B. E. Fernow, of the Division of Forestry in the Department of Agriculture, who, in his official capacity, is taking an active interest in the introduction of metallic ties upon American railroads, in order that the present demands shall not continue to be made upon the forests of this country to supply the wants of railroad builders.

Mr. S. L. Roberts, of the Amboy Division of the Pennsylvania Railroad, has added to the collection previously deposited by him, a number of objects illustrating the development of the rail splice. These objects were mainly collected from the old Camden and Amboy Railroad.

The value of the collection of telegraphic apparatus has been greatly enhanced through the enthusiastic coöperation of Mr. George C. Maynard, of Washington, secretary of the American Association of Inventors and Manufacturers.

During the annual convention of the Old Time Telegraphers' Association their loan collection of telegraph apparatus was, at his suggestion, placed on exhibition in the section, and attracted much attention.

Among the important objects since deposited are to be found the cross-arm and insulator laid on the line from Washington to Baltimore in 1841; a register and relay used in the first office opened in Indiana in 1848; twisted telegraph wire used in 1864; various forms of earthenware and glass insulators, and a pair of English dial telegraph instruments.

The collection showing the development of the typewriting machine has received several valuable additions, among them the typewriter invented by John Pratt in 1864, which was obtained through his kindly assistance.

Messrs. Wyckoff, Seamans & Benedict have added a Danish writing-ball and other old forms of typewriters to their collection, among them a model of the Sholes & Glidden typewriter invented in 1867, together with the original of one of the first machines made from this model.

The curator has received communications from the Caligraph Company and Mr. W. H. Travis, of Philadelphia, both of whom promise valuable additions to this collection.

The Singer Manufacturing Company has increased the collection of sewing machines referred to in the last report.

The application of Jesse Ramsden for a patent for an equatorial instrument, written and signed by himself, has been presented to the Museum by Mr. Park Benjamin and placed in the case with the original dividing engine, deposited a few years since by Dr. Morton, president of Stevens Institute.

Among the relics, attention may be called to the plaster model from which the bronze tablet for the monument erected at Bordentown by the Pennsylvania Railroad Company was cast. This model was received through Mr. J. T. Richards.

A sedan chair, decorated with gold and handsomely upholstered, which was owned and used by the royal family of France during the reign of Louis XIV, has been deposited in the collection by Miss Katherine Parsons, of Washington.

The recent increase of popular interest in matters relating to the history of transportation is most remarkable, while the recognition of the importance of illustrating this phase of human effort by the managers of American expositions is none the less gratifying.

At the Centennial Exposition of 1876 a single old steam locomotive and car were exhibited, together with a few implements of transportation, shown in the ethnological collection. At New Orleans, ten years later, a single railway exhibited a series of models of ancient locomotives and cars. At Cincinnati, in 1888, the first synoptical exhibit showing the development of the art of transportation was made by the U. S. National Museum in the Government building, where a very limited space could be devoted to the subject.

At the World's Columbian Exposition, four years later, a handsome exhibition building containing 250,000 square feet of floor space has been erected, which, together with the annex, occupies an area of over 17 acres.

It is indeed a matter of the greatest satisfaction to know that the importance of that place in history which is occupied by the record of the development of the methods of intercommunication through which our national growth has been so greatly accelerated during the century, is thus to receive due recognition.

The extent of the collection of transportation exhibits, together with the publications in relation thereto, can not fail to make a permanent and world-wide impression, both upon the visitors who see, and those absent who read of their magnitude.

Thus will the future generations be made to understand the influence which the world's great systems of transportation have had upon the progress of civilization during the four centuries since Columbus sailed away from Palos in a caravel.

REPORT ON THE SECTION OF MATERIA MEDICA IN THE U. S. NATIONAL MUSEUM, 1892.

By WILLIAM S. DIXON, *U. S. Navy, Honorary Curator.*

During the year ending June 30, 1892, the labeling of specimens and illustrations of plants, etc., in the exhibit was completed. Several specimens that had deteriorated were replaced by good examples. Efforts were made to identity some of the vegetable specimens presented to the Museum. Their accompanying history being meager, and essential characteristics absent, a satisfactory recognition was impossible.

The accessions during the year number 55, and were received principally from the Royal Kew Gardens, England. Several specimens were received from W. H. Schieffelin & Co., in response to special request. The arrangement of this section is, essentially, as left by Dr. Flint, the first curator of this collection.

The following table shows the number of specimens in the various series:

Exhibition series		3,346
Reserve series		1,223
Duplicate series		859

In addition to which there are—

Colored plates	662	
Photographs	102	
Herbarium specimens	60	
Micrographs	38	
		862
		6,290

The last catalogue entry in June, 1891, was 142225, and in June, 1892, 142280.

REPORT ON THE DEPARTMENT OF PREHISTORIC ANTHROPOLOGY IN THE U. S. NATIONAL MUSEUM, 1892.

By THOMAS WILSON, *Curator*.

GENERAL REVIEW OF THE YEAR'S WORK.

The general character of the work of the past year is not greatly different from that of other years. There is the same reception of specimens, their classification, entering, numbering, and cataloguing; they then have to be marked and put in the display cases assigned to the State to which they belong, or if not classified geographically, among other specimens of the same kind.

The curator was engaged during the first part of the fiscal year upon the preparation of a work which he considered was needed in the United States—a gathering or collection of the evidences of high antiquity of man in America. Later on, he took up a particular chapter of that work, to wit, that on arrow- and spear-heads or knives. Before the latter was entirely completed, he was called upon to prepare an exhibit for the Exposicion Historico-Americano, held at Madrid,* Spain, in celebration of the fourth centenary of the discovery of America by Christopher Columbus.

It was believed that the display made for Madrid could be utilized for the Chicago Exposition, and the work thus done in the current year would serve equally well for the display to be made in the subsequent year, but that hope has not been realized.

The number of specimens received during the past year is about equal to the average of former years, amounting to nearly ten thousand specimens.

IMPORTANT ACCESSIONS RECEIVED DURING THE YEAR.

From Dr. Edward Palmer: A collection of objects from an ancient Indian village site 3½ miles NW. by N. from Manzanillo, Mexico. A large obsidian implement, 3 polished hatchets, a hammer stone, a rubbing stone, fragment of a metate, 5 clay vessels, 90 fragments of pottery, 22 small grotesque clay figures (human form), 15 ornamental clay beads, 5 obsidian flakes, a shell ornament, an animal tooth, a fragment of human jaw with teeth (child), a stone ax, and a quantity of broken pottery (not counted); one hundred and forty-nine specimens. From Mr. Palmer's notes concerning this collection the following extracts are taken: "In a secluded cove of the harbor of Manzanillo is an embankment several feet above high tide, upon which is a thicket of bushes and trees. Removing these and by digging, remains of an Indian village site containing stone implements, pottery, etc., are discovered. Much excavating has been done, and some of the embankment from time to time has crumbled down, tending to still more break the pottery. It would seem that at the time of its abandonment (probably during the Spanish conquest) much of the material was broken and destroyed, as none of the stone mortars and metates are complete." With this accession were also received 46 fragments of clay figures (mostly human form), from ancient house sites near the village of Almeria, State of Colima, Mexico, 30 miles east of Manzanillo. Mr. Palmer says: "A railroad cut revealed the house sites. The surface in places shows rocks of different forms and sizes placed in rude circles. The Indians who once lived here were removed by force, and that would account for the fragmentary condition of most of the objects found."

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* Mr. Wilson sailed from New York for Madrid on the 27th of July. The exposition was to open in that city on the 13th of September, though it did not actually do so until the 30th of October. It closed on the 1st of February, and the display has not returned at the time of writing this report, although Mr. Wilson did not remain during the entire period of the exposition.

In addition to the above-mentioned objects was sent a human skeleton* with painted bones, from a cave on the island of Espiritu Santo, near the harbor of La Paz, Lower California.

From the Royal Zoölogical Museum, Florence, Italy, through Prof. Henry H. Giglioli: Twenty-five worked flint flakes, a terra-cotta ball, a terra-cotta *fusaiole* of unusual shape, 2 earthenware vases, a boar's tusk, and a point of roebuck's horn, from the cave of Lazzaro, Rosilini, near Modica, Sicily (see Bull. Paletnologia Ital. VII, 1892); bone breccia with worked flints imbedded, from cavern of Les Eyzies, Dordogne, France, Lartet & Christy; 6 fragments of subfossil bones and 2 teeth of equus and 10 worked flint knives and scrapers from a cave on the island of Levanzo (Egades), W. Sicily—discovered by Prof. H. H. Giglioli, August 29, 1890; 7 flint knives and scrapers and two arrowheads, from Sartiano, Siena, Italy; 2 flint knives, a scraper, and 13 arrowheads, collected in the vicinity of Florence, Italy; portion of a flint borer, found at the Thermæ of Caracalla, Rome, Italy; 3 casts in wax of beautiful flint implements (knife, arrowhead, and a dagger, or spearhead), from an Etruscan tomb at Saturnia, Tuscan Maremma.† The originals are in the Museum of Anthropology at Florence; 2 flint knives found at Bari, Puglia, southeast Italy; a stone *fusaiole* found near Arezzo, Tuscany; blade of a bronze dagger, found near Cortona, Tuscany (rare); 2 primitive bronze figures (human), votive or sacred, from an Etruscan tomb near Chiusi, Italy (rare); 2 bronze man heads, spikes, from Etruscan necropolis, near Chiusi (rare); a Roman sling-stone in lead, with inscription, found near Ascoli-Piceno, Italy (rare); an Etruscan sling-stone in lead, with inscription, found near Cortona, Italy (rare) (this specimen is similar in shape to the sling-stones of steatite used by the natives of New Caledonia); a small silver *fibula*, Greco-Italic, from an ancient tomb near Capua, southern Italy; plaster cast of a small stone chisel from the Santa Cruz district, Jamaica, West Indies (the original is in the archæological museum, at Cambridge, England); a worked flint knife or scraper from the Babel-Maluk Valley, near Thebes, Egypt, and 5 flint flakes found with many similar ones near Baalbec, Syria; collected by Dr. Verio in 1890; 5 fragments of rudely ornamented pottery, 3 shells, 26 bones of a pig (*Sus andamanensis*), and 2 bones of a fish from a Kitchen-midden, near Port Blair, Andaman Islands, Bay of Bengal (relics of the aborigines), collected by E. H. Man, esq.; 7 fragments of coarse pottery from a mound on the Manatee River, British Honduras, collected by J. Ballamy in 1890; 6 rude figures in coarse terra cotta, excavated from ancient tombs on the bank of the Rio Tajajos, Province of Para, Brazil; the figures represent an owl, a tortoise, a sitting human figure, the legs of a bird, a human head, and a cone-shaped object, collected by A. M. d'Almeida Leal in 1889. Entire number of objects received, 146. (Acc. 24918.)

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*The skeleton was presented to me [Mr. Palmer] by Gaston Vevis, esq., of La Paz. Nothing was reported to have been found with the bones. (Acc. 24600.)

†The question "Whence came the Etruscans" is probably the foundation of the oldest dispute or discussion known to history. It began in the fifth century B. C., between Herodotus and Dionysius of Halicarnassus, and continued until the nineteenth

From the National Museum of Anthropology and Ethnology, Florence, Italy, through Dr. Paolo Mantegazza, curator: A collection of archæological specimens from Italy; a fragment of worked wood and a plaster cast representing a somewhat similar piece, from the lacustrine habitation at Mecurago, Province of Novara (bronze age): model in plaster of a perforated stone disk, and a fragment of pottery from lacustrine habitation at Isolino, Lake Varese; fragment of pottery (brulé), Terramare de Noceto, Parma; fragment of pottery from the cave of Bergeggi (Savona); terra-cotta spindle whorl *fusaiole* from Mount Calamita, island of Elbe; two polished hatchets from Casentino, and one from Mount Cuccoli, Tuscany; polished stone hatchet (diorite) from the Province of

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century. The discovery in this country of prehistoric man with his ages of stone and bronze has settled the question that the Etruscan country was occupied long prior to the Etruscan civilization, and, there being nothing to the contrary, we may suppose that the former occupants were the ancestors of the Etruscans. Some of the monuments at Saturnia were dolmens and have been recognized as belonging to the prehistoric ages of stone or bronze. It may, therefore, be doubted whether the "beautiful flint implements" mentioned really came from an "Etruscan tomb" at Saturnia. As they are similar in every particular to prehistoric flint implements, it has been contended that they belonged to the ages of stone or bronze, and were earlier than Etruscan.—Curator.

Teramo; model in plaster of a small polished stone hatchet, the original from a lacustrine habitation, Lake Varese; 2 arrowheads of flint, barbed and stemmed, from Ascoli-Piceno; 2 flint arrowheads, barbed and stemmed, from Montorio, Abruzzi; 2 flint arrowheads from Sarteano, Province of Siena; an arrowhead and 2 worked flint flakes from the valley of the Vibrata, Abruzzi (collection of Dr. Concerio Rosa); 2 flint flakes or knives from the valley of the Vibrata and 1 from the Ambra; a bronze hatchet from Maremma, Tuscany.

The following objects (11 in number) are from different localities on the island of Elbe, collected by Dr. Raffaello Foresti: Two flint scrapers, Cala Giovanni; a large worked flint flake, Santa Lucia; a flint scraper and a rude point, San Martino; a large worked flint flake, Tre Acque; a flint flake—retouched—(graver?), Valley of the Inferno; piece of worked stone, San Martino; a worked flint flake, Lito; a flint flake (double ended) and a small polished hatchet from Lacona. (Acc. 24919.)

From the same source were also received 3 modern oak disks from interior Italy, turned in a lathe and decorated with concentric rings. The sizes of these disks are respectively 6¾ by 2, 4¾ by 1½, 3¼ by 1⅜ inches. The North American Indians had a game called Chungkee, played with disks of stone by rolling them on the ground or court. These wooden disks are used in Italy to play the similar modern game of Ruzzole (called Ruzzoletta when played by children with the small disks). It is sometimes played by peasants, when they use disks of cheese in the form common to the country, betting one cheese against the other, the winner taking both. It is then called "Giuocco del Formaggio," or play of the cheese. It is played by two persons, but may be by four, arranged in opposing sides. The game is played similar to quoits, except that the disks are rolled on the ground instead of being pitched through the air. Goals or marks are established, and the player, standing alternately at one, rolls toward the other, the disks nearest the mark being the winners. This game is of great antiquity, and is believed to be a survival of the classic game represented by the antique statue of Discobolus. (Acc. 24919.)

From A. W. White, Albert Lea, Freeborn County, Minn.: A rude chipped implement found 15 feet below the surface in glacial drift formation of a railroad cut in Freeborn County; also arrow and spear heads, surface finds from the same locality; 7 specimens. (Acc. 25492.)

From Alfred Pruden, Dayton, Ohio: A copper ax found in an Indian mound corner Fifth and Mound streets, Dayton, Ohio. (Acc. 25113.)

From Warren K. Moorehead, Xenia, Ohio: Large altar of baked clay (weight, 500 pounds), from a mound in the Scioto Valley, on the north fork of Paint Creek, Ross County, Ohio. These altars are formed by placing a mass of clay on the surface of the ground, hollowing it out, as seen in this specimen, and burning it to a brick-like hardness. The cavity usually contains relics and human bones. (Acc. 25003.)

From M. L. Marks, Sixth Auditor's office, Post-Office Department, Washington, D. C.: Five gold ornaments from ancient graves in the United States of Colombia. (Acc. 25150.)

From Edward S. Thompson, Thompsontown, Pa.: Large collection of aboriginal relics found along the banks of the Juniata River, between Thompsontown and Port Royal; arrow and spear heads, perforators, rude chipped implements, a chipped disk, notched sinkers, a polished hatchet, fragments of steatite and pottery vessels, pieces of clay ironstone (slightly worked), and fossil shells; 408 specimens. (Acc. 25117.)

From A. C. Carlisle, through Charles Seidler, No. 46 Eyot Gardens, Hammersmith, London, England: A large collection of chipped implements, principally flakes, knives, crescents, etc., of agate, chalcedony, jasper and chert, from caves in the Vindhya Hills, central provinces of India. Discovered and collected by A. C. Carlisle, esq., late of the Archæological Survey of India; 1,674 specimens. This is an interesting and valuable acquisition to the Museum. Archæological specimens from India are hard to obtain, and previous to this occasion our representation from this locality was extremely small—less than 100 objects. The long, thin flakes and the crescent-shaped implements are the perfection of flint chipping. (Acc. 25122.) This collection is described in a separate paper.

From De Witt Webb, M. D., St. Augustine, Fla.: A large collection from Shell Mound near St. Augustine: Perforated shells (club heads?), shells used as food, scrapers, hatchets, perforators, sinkers, spoons, ladles, etc., of shell; also bone implements, stone mortars and pestles, bones of fishes, animals and birds, fragments of pottery, and parts of two human skeletons; 433 specimens in all. (Acc. 25232.) This collection to be described in a separate paper.

From the Bureau of Ethnology of the Smithsonian Institution (through Maj. J. W. Powell, Director of the Bureau): A collection of aboriginal objects from a mound near Linville, Rockingham County, Va: Chipped flint implements, hammer stones, polished hatchets, perforated tablets, stone and clay pipes, implements and ornaments of shell and bone, clay vessels, fragments of pottery, and human skulls and bones. One hundred and forty-two specimens (packages of shell beads, fragments of pottery and of bone, counting as one number). The mound was explored by Mr. Gerard Fowke, and will be described in a future report of the Bureau of Ethnology. (Acc. 25306.)

From O. N. Bryan (bequest of), through George R. Bryan, Marshall Hall, Md.: Large collection, containing rude chipped implements (paleolithic type), leaf-shaped implements, knives, scrapers, perforators, arrow and spear heads, rude notched axes, hammer stones, pitted stones, chipped and polished hatchets, grooved axes, bowlders and slabs with mortar-like cavities, notched sinkers, drilled tablets and ceremonial objects, carved pipes of steatite, fragments of pottery, and steatite bowls. The above specimens are mostly surface finds from the Bryan plantations in Charles and Prince George's counties, Md. The materials are principally quartz, quartzite, hornstone and rhyolite. There are also arrow and spear heads, scrapers, etc., of flint and jasper, from Ohio, Indiana, Illinois, North and South Carolina. A number of polished hatchets (locality not given); fragments of pottery from Massachusetts, Georgia, Florida, Kentucky, Ohio, and from the pueblo of Moqui, Ariz. 2,674 specimens in all. (Acc. 24837.)

From Edward Lovett, West Burton House, Outram Road, Croydon, England: Twenty-two rude flint implements and worked flakes (paleolithic), from Norfolk, Suffolk, Devon, Cheswick, Ightham, Hanwell, and Stamford; also 44 worked flint flakes (neolithic), from the Thames River and from Capel, Sussex, England. (Acc. 25615.)

From Henry Balfour, Anthropological Museum, Oxford, England: A flint core, 4 paleolithic implements from France, a flint scraper, and a small polished hatchet from the cavern of Les Eyzies, France; 5 flint scrapers from South Downs, Dorset County, England, and 3 stone hatchets (Carib), from the West Indies. (Acc. 24703.)

From Charles H. Russell, Bowling Green, Ohio: A bird-shaped carving of banded slate from Center Township, Wood County, Ohio. Fine specimen. (Acc. 25625.)

From F. J. Johnston, New Carlisle, Clark County, Ohio: Collection from a gravel pit near New Carlisle, of bone perforators and chisels, pieces of worked bone, animal teeth, broken flint spear heads and fragments of a human skull. (Acc. 25633.) From letters received with the specimens, the following extract is taken:

> "The ridge in which the pit was dug is of a glacial formation, having a southeastern and northwestern direction. The gravel is in layers and reaches to the surface. On the top of the ridge the gravel has been removed, making a boat-shaped hole, length about 15 feet, width in center 6 feet, depth in center 4 feet. In this cavity, which was filled with red clay mixed with gravel, the specimens were found.
>
> Nos. 1 and 2 (fragments of a human skull) were found within 1 foot of the surface, with no evidence of other bones. A piece of a skull was found within 6 inches of the surface. Nos. 3, 4, 5, 6, and 7 (a beaver tooth and four bone points) were taken from the southern end; also the broken spear heads and a conglomerated mass of human bones. Several ribs were found between two femurs. All the skeletons found separate (9) were lying with their heads to the west of north."

From William S. Thomas, Washington, D. C.: A large collection from the District of Columbia of hammer stones, rude chipped implements (principally quartzite), notched axes, chipped hatchets, partly polished arrow and spear heads of quartz, quartzite, and felsite, perforators, scrapers, grooved axes, drilled ceremonial objects, fragments of pottery, a small piece of steatite with groove, and parts of a human skull; also a polished stone hatchet from Duchess County, N. Y., with a hole drilled in the upper portion, and fragments of pottery from Georgia. 434 specimens. (Acc. 25675.)

From A. Stephenson, Cincinnati, Ohio: An arrowhead of quartz crystal from San Miguel Island, California. Fine specimen. (Acc. 25720.)

From Mrs. B. D. Spencer, Brooklyn, N. Y. (through Dr. H. T. Cresson, of Philadelphia, forwarded by Prof. F. W. Putnam, of Peabody Museum): A pyrula shell with an engraving of a mastodon or grand pachyderm, human and animal teeth, shell beads, bone implements, stone arrow and spear heads, perforators and scrapers, and a piece of wood, showing the cutting marks of a stone ax, from the peat and fallen forest layer and neighboring locality near Holly Oak Station, Philadelphia, Wilmington and Baltimore Railroad, Delaware. These objects were discovered by Dr. H. T. Cresson and M. Sarault in 1864. Seventy-nine specimens. (Acc. 24695.)

From R. Forrer, Strasburg, Germany: Thirty-four pieces of pottery (Samian ware) of Roman manufacture, each one having a name stamped upon it; and 25 pieces of Coptic cloth. (Purchased.) The name given to these has been Coptic cloth, because they were made principally at the city of Coptos, which was located about halfway between the cities of Thebes and Panopolis. Thence this commerce was carried in every direction both through Egypt and Ethiopia, and these and similar cloths have been found as far north as Fayum. There are evidences of Greek, Roman and Byzantine influences. Some of the fabrics were woven in the loom with shuttles, but others were made as tapestries. They are usually of flax, though wool is interwoven. Silk was known in that day, but seemed to have been such a luxury that its use was uncommon. Some of these cloths have been described by Herodotus and Strabo. The use of this and similar fabrics made with the loom in Egypt dates from high antiquity. Many of these are tapestries and woven in the same manner as the Gobelins. They were all used as garments and were the burial dress of their owners, having been exhumed from the graves of the neighborhood. They date from the first to the seventh century, A. D. These objects will be described in a separate paper. (Acc. 24690.)

ROUTINE WORK, CLASSIFICATION AND ARRANGEMENT OF COLLECTION.

This department of the Museum, consisting, as it does, of antiquated bones, stones, and pottery, much of it in fragments, is not attractive to the ignorant visitor. Its objects have been known throughout historic times without exciting public interest. If they have been gathered, it was from curiosity. All this has been changed by the discovery of prehistoric man. Now the objects take their proper place as evidence of the antiquity of man, and are regarded with proper interest and given their true value. But this requires an understanding of the objects and their relation—man and man's industry. This is explanatory of the statement that in my department visitors frequently call upon me for explanations, and ask my opinion upon objects, sometimes those in the Museum, at other times those owned and brought by the visitors, and this adds much to our routine labor. I approve this idea, and have always done what I could to satisfy this laudable scientific curiosity on the part of the public. I remember that this is a Museum for the people as well as an organization for the advancement of science.

The number of entries in the loan book during the year was 26. Specimens entered in this book are principally sent for examination and report, sometimes with regard to purchase, but more often classification, probable use, etc., is desired. This requires more or less correspondence with the parties sending, and after the report is made, repacking and return of the specimens.

Subject to these explanations, the routine work of former years has been kept up.

DISTRIBUTION OF DUPLICATE ARCHÆOLOGICAL SPECIMENS.

The following statement indicates the distribution of archæological specimens by the National Museum during the year ending June 30, 1892:

To Herbert E. Brock, Mason City, Iowa; 57 archæological specimens in exchange for fossils. (Sent July 24, 1891.)

To Mrs. D. B. Meacham, Ridgway avenue, Amidale, Cincinnati, Ohio: 17 archæological specimens in exchange. (Sent February 11, 1892.)

To Herbert E. Brock, Mason City, Iowa: 50 specimens of arrow and spearheads, in exchange for Crinoids. (Sent March 23, 1892.)

PRESENT STATE OF THE COLLECTION.

Number of specimens in the collection as indicated in the report for the preceding year	127,890
Number of specimens received in the department during the year ending June 30, 1892, and entered in Vol. XXXI, Museum Catalogue	9,594
	137,484
Specimens sent in exchange	312
Now on hand	137,172

CATALOGUE.

Number of last entry in June, 1891	148,133
Number of last entry in June, 1892	149,401

In the Bibliography (Section IV) will be found references to several papers which have been published by the curator during the year.

REPORT ON THE DEPARTMENT OF MAMMALS IN THE U. S. NATIONAL MUSEUM, 1892.

By FREDERICK W. TRUE, *Curator.*

As regards the regular work of the department, the year covered by this report was less productive of results than its predecessors. The time of the Curator was occupied by other duties for one-third of the year. The preparations for the World's Fair were in progress, and arrangements could not be made to secure the services of a skilled assistant to replace the assistant engaged in field work. As intimated in last year's report, it is probable that normal conditions will not return until after the close of the work for the World's Fair. In the meantime little can be done beyond protecting the collections from deterioration.

In number and importance the accessions will compare favorably with those of former years.* The principal accessions are here referred to:

Many foreign mammals have been obtained through the continued kindness of the friends of the Museum, and important additions to the series of American species have also been made in the same manner, and to a certain degree by purchase.

Dr. W. L. Abbott, to whom the Museum is indebted for a valuable collection of East African mammals, supplemented his donation by a collection from Central Kashmir, including a fine series of skins of the Rhesus monkey, a Thibetan bear, and other interesting species. Mr. William Astor Chanler presented two excellent mounted heads of giraffes, a male and a female, from East Africa. A very valuable collection of skins of marsupials, including 12 species of kangaroos and wallabies, was received from the Australian Museum. Most of these were previously unrepresented in the Museum collections.

Capt. M. A. Healy, U. S. Revenue Marine, obtained for the Museum the skin of a female walrus from Holy Cross Bay, Siberia, an excellent mate for the male obtained last year by Capt. Coulson. Through the kind offices of Dr. C. H. Merriam, of the Department of Agriculture, and Mr. C. A. Townsend, of the U. S. Fish Commission, four sea lions, *Eumetopias stelleri*, and two harbor seals were obtained from Monterey, Cal. Dr. Merriam also aided the Museum in obtaining from Newfoundland three gray seals, *Halichœrus grypus*, a species rare in American collections. A fine adult male hooded seal, *Cystophora cristata*, was obtained by Rev. M. Harvey, of St. Johns, Newfoundland.

The Mexican Boundary Commission began field work during the year. Dr. Edgar A. Mearns, U. S. Army, who was appointed surgeon to the Commission, expressed his desire to make zoölogical collections for the Museum and was supplied with traps, preservatives, and other collecting apparatus. He has entered enthusiastically into the work and sent in from the border large collections of finely prepared specimens.

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* No attention is paid at this time to the numerous specimens obtained for the World's Fair. These will be mentioned in next year's report, when a detailed account of the work done for the exhibition will be submitted.

As the collections made in this region by the earlier Boundary Survey have largely deteriorated, this fresh material is of great interest.

Mr. P. L. Jouy, who was detailed from the department for field work, made considerable collections during the year in Southern Arizona, and in Sonora and San Luis Potosi, Mexico. A skin of the coati, *Nasua nasica*, was obtained by Lieut. John S. Winn, U. S. Army, in the Huachuca Mountains of Arizona. This is one of the earliest evidences of the presence of this singular animal in the United States.

The Museum was permitted by Capt. W. H. Cassel to obtain in Druid Hill Park, Baltimore, four Virginia deer—two buck, a doe, and a fawn. The park had become overstocked, and it was necessary to reduce the number. A skeleton of the white-beaked dolphin, *Lagenorhynchus albirostris*, was received in exchange from Prof. Robert Collett, of Christiania, Norway.

The mounted skin of a dolphin, *Delphinus delphis*, from Carmel Bay, California, was purchased.

Specimens of the rare American bats, *Macrotus californicus* and *Promops californicus*, were presented by Mr. George A. Allen. Indian agent in Yuma County, Ariz. Mr. E. L. Storment also presented a specimen of the latter species and one of *Atalapha cinerea*.

The President deposited in the Museum an armadillo sent him by Mr. R. R. Skaggs, of Breckenridge, Tex.

A considerable collection of small mammals from the vicinity of Fort Snelling, Minn., was presented by Dr. Mearns. Small mammals from Texas and California, needed to fill gaps in the study series, were purchased from Mr. C. K. Worthen, of Warsaw, Ill

A number of skeletons of species of ruminants and other mammals previously unrepresented in the collections were obtained from the Muséum D'Histoire Naturelle in exchange.

During the year more than 50 mammals, including a moose, 3 bears, 4 goats, and other large forms, were received from the National Zoölogical Park. While the loss of so many animals by the Park is to be regretted, it seems inseparable from enterprises of this kind, and is in some degree counterbalanced by the gain to the Museum.

No important changes have taken place in the exhibition hall during the year, and no groups were added. A few skins were mounted by the taxidermists, who have had little time, however, to devote to the regular work of the Museum. The chief addition was a portion of the Abbott collection, mounted by Ward's Natural Science Establishment.

The list of new mounted skins is as follows:

White-collared Mangabey, *Cercocebus collaris*.
Common Macaque, *Macacus cynomolgus*.
Pig-tailed Macaque, *Macacus nemestrinus*.
Yaguarundi cat, *Felis yaguarundi*.
Gray wolf, *Canis lupus* (Florida).
Striped skunk, *Spilogale* sp. (semi-albino).
Striped ichneumon, *Crossarchus mungo* (Abbott Coll.).
Squirrels (4 species).
Tana, *Tupaia tana*.
Hedgehog, *Erinaceus europæus*.
Giraffe (heads of male and female).
White-maned gnu,[*] *Connochætes taurinus albojubatus*.
Reed buck, *Eleotragus arundinaceus*.
Pencil-eared oryx, *Oryx callotis*.
Water buck, *Kobus ellipsiprymnus*.
Bush buck, *Tragelaphus scriptus roualeynii*.
Coke's hartebeeste, *Alcelaphus cokii*.
Pallah antelope, *Aepyceros melampus*.
Grant's gazelle, *Gazella grantii*.
Thomson's gazelle, *Gazella thomsonii*.
Abbott's antelope, *Cephaloplus spadix*. (Type.)
Black-fronted pygmy antelope, *Cephalophus nigrifrons*.
Damara-land pygmy antelope, *Neotragus damarensis*.

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[*] This and the succeeding antelopes are all males, from the Abbott collection.

The regular routine work of the department, identifying specimens, cataloguing, assorting, and rearranging, was carried on as usual. For the Department of Agriculture collection, 5,897 skins and 5,884 skulls were catalogued by our clerks. A large number of skulls of small mammals belonging to this collection were cleaned during the year, but large numbers remain uncleaned. The Museum also made up a considerable number of skins of foxes, skunks, coatis, peccaries, bears, etc., belonging to this series.

No special report on the work of the taxidermists can be made with advantage at this time. Only two taxidermists were retained on the Museum roll during the year, and these were engaged for the greater part of the time in work connected with the World's Fair exhibits. Nothing could be done to decrease the number of skins in pickle, though it is unfortunate that some of them should remain longer unmounted.

Mr. P. L. Jouy, formerly assistant in the department, was engaged in field work during the year. The explorations of Dr. Mearns have already been referred to.

A few specimens were loaned for study or distributed during the year. These were: To Dr. J. A. Allen, New York, 3 skins and 5 skulls of *Capromys*, for study; to Mr. William Taylor, San Diego, Tex., 5 skulls of North American mammals, in exchange; to Dr. Harrison Allen, Philadelphia, Pa., 2 skeletons of fruit bats, for study.

Identifications of North American mammals were made for Mr. G. S. Miller, Jr., of Cambridge, Mass. Mr. G. H. Ragsdale, of Gainesville, Tex., received information regarding the distinguishing characters of the various species of American cats.

The number of specimens in the several series, June 30, 1892, was as follows:

Number of mounted skins in the exhibition series	838
Number of skins and alcoholic specimens in the study and reserve series	9,476
Number of skins and alcholic specimens received during the year	709

The last entries in the several catalogues June 30, 1892, were as follows:

Regular series:	
Skins and alcholics	20,175
Skulls and skeletons	35,527
Department of Agriculture deposit:	
Skins	34,328
Skulls	46,419

REPORT ON THE DEPARTMENT OF BIRDS IN THE U. S. NATIONAL MUSEUM, 1892.

By ROBERT RIDGWAY, *Curator.*

GENERAL REVIEW OF THE YEAR'S WORK.

In addition to the regular routine work of the department, which of itself is too complicated to admit of specific description, the following special work was accomplished during the year. It may be premised that all such work has been done at irregular intervals, or only when time could be spared from the more exacting duties of the curator.

The working up of a collection of birds from Honduras and another from Costa Rica was completed during July, and the results turned in to the editor of the "Proceedings" for publication. Considerable work was also done, as opportunity occurred, on a revision of the genera *Sittasomus* and *Formicarius*, besides other groups, the results of which, so far as the work has been completed, are mentioned by title in the Bibliography (Section IV).

In August, the transferring of specimens constituting the study collection to new trays was begun, as was also the consideration of plans for an exhibit of birds at the World's Columbian Exposition, the cataloguing and putting away of the Richmond collection of over 3,000 specimens, the separation of duplicates from the same, and numerous other matters.

The rearrangement of the study collection in the new cabinets was continued in September until all the cabinets in the gallery were filled.

In April, a large collection of birds from Cashmir, presented by Dr. W. L. Abbott, was worked up, involving considerable labor, since most of the material was entirely new to the Museum. Much work has also been done on a large collection of birds from the Galapagos Islands.

As time and facilities afforded, a large amount of difficult and laborious work was performed in the rearrangement of specimens in the west basement, where modern cabinets had been substituted for some of the various kinds of unsuitable cases in which this extremely valuable part of the collection had been stored. The work is far from finished, however, and can not be completed until after the World's Fair exhibit has been disposed of.

A very considerable part of the curator's time was employed in the consideration of plans and details of execution for an exhibit of birds at the World's Columbian Exposition. This matter was embarrassed by many obstacles, the most serious of which was the extreme difficulty experienced in securing competent skilled assistants. It was also found very difficult—in some cases impossible—to obtain the necessary material; and, owing to the novel character of the work undertaken, much time was necessarily spent in experiment. Further time was lost by illness of assistants; but, all these hindrances taken into consideration, the progress of the work has been satisfactory, and unless the value of the exhibit is impaired by material reduction of its extent, a highly interesting and instructive collection will be produced.

NOTES UPON THE MORE IMPORTANT ACCESSIONS RECEIVED DURING THE YEAR.

The number of specimens entered in the Museum register of birds during the year 1891–'92 is 5,608 (catalogue numbers 120753 to 126349, inclusive, and 126351 to 126361, inclusive), the more important accessions being the following:

From Dr. W. L. Abbott, Philadelphia, Pa., 362 specimens (number of species undetermined), from Cashmir, India. (Gift.)

From C. F. Adams, Champaign, Ill., 2 specimens of the American Flamingo (*Phœnicopterus ruber*), from the Galapagos Islands. (Purchased for the World's Fair exhibit.)

From the American Museum of Natural History, New York City, 91 specimens (31 species), from Chapada, Matto Grosso, Brazil. (7 species new to the collection.) (Exchange.)

From F. B. Armstrong, Brownsville, Tex., 2 specimens of Chachalaca (*Ortalis vetula mccallii*), from Texas. (Purchased for World's Fair exhibit.)

From the Auckland Museum, Auckland, New Zealand, 58 specimens (37 species) of New Zealand birds, many new to the collection. (Exchange.)

From the Australian Museum, Sydney, New South Wales, 137 specimens (90 species), from Australia, most of the species new to the collection. (Exchange.)

From Rollo H. Beck, Berryessa, Cal., 98 specimens (58 species), from California. (Gift.)

From L. Belding, Stockton, Cal., 1 specimen Blue Goose (*Chen cærulescens*), from California. (Gift.) 6 specimens (3 species), from California. (Gift.) 17 specimens (11 species), chiefly from California. (Gift.)

From Lieut. Harry G. Benson, U. S. Army, Sequoia Reservation, California, 3 specimens Black-chinned Humming Bird (*Trochilus alexandri*), from California. (Gift.)

From A. Boucard, London, England, (*a*) 11 specimens (11 species) birds of Paradise (purchased for World's Columbian Exposition); (*b*) 12 specimens (10 species) parrots (purchased for the Museum); (*c*) 24 specimens (24 species) humming birds (purchased for the World's Columbian Exposition); (*d*) 12 specimens (10 species) parrots (purchased, part for the Museum, part for World's Fair group); (*e*) 3 specimens (same number of species) birds of Paradise, from New Guinea (purchased for World's Fair exhibit).

From Walter Brett, Lakeport, Cal., 2 specimens of Double-crested Cormorant (*Phalacrocorax dilophus*), from California. (Gift.)

From H. H. and C. S. Brimley, Raleigh, N. C., 4 specimens (3 species), from North Carolina. (Purchased.)

From Edward J. Brown, Washington, D. C., 4 specimens Seaside Sparrow (*Ammodramus maritimus*), from Cobb's Island, Virginia. (Exchange.)

From O. N. Bryan (deceased), Marshall Hall, Md., 12 specimens (9 species), chiefly from Marshall Hall, Md. (Bequest. This bequest contained a much larger number of specimens, but nearly all were so badly moth-eaten and infected with insects that it was necessary to burn them.)

From James C. Carter, New York City, a fine specimen of hybrid Mallard (*Anas boschas*) and Pintail (*Dafila acuta*), from Swan Island, North Carolina. Also a European Widgeon (*Mareca penelope*), from the same locality. (Gifts.) Two specimens of the American Merganser (*Merganser americanus*), in the flesh, from Chesapeake Bay. (Gift.)

From C. T. Cooke, Salem, Oregon, a pair of Steller's Jay (*Cyanocitta stelleri*), from Salem, Oregon; parents of nests and eggs purchased for oölogical collection. (Gift.)

From C. B. Cory, Boston, Mass., 1 specimen of the Crocodile Bird (*Pluvianus ægyptius*), from Egypt. (Gift.)

From B. L. Cunningham, Fort Klamath, Oregon, 3 specimens (2 species), from Fort Klamath. (Gift.)

From S. F. Denton, U. S. Fish Commission, 1 White-bellied Sea Eagle (*Haliæetus leucogaster*), from Queensland, Australia. (Gift.)

From Department of Agriculture (through Dr. C. Hart Merriam, chief of Division of Economic Ornithology and Mammalogy). 2 specimens Florida Bobwhite (*Colinus virginianus floridanus*) and 2 of Chestnut-bellied Scaled Partridge (*Callipepla squamata castanogastris*).

From A. Dugès, Guanajuato, Mexico, 3 specimens (3 species), from various localities in Mexico. (Gift.)

From Bruno Geisler, Finschhaven, Dutch New Guinea, 29 specimens (7 species), chiefly birds of Paradise, from New Guinea. (Purchased.)

From E. M. Hasbrouck, Washington, D. C., 1 Carolina Paroqnet (*Conurus carolinensis*), from Florida. (Purchased for World's Fair exhibit.)

From F. H. Hitchcock, Department of Agriculture, 1 specimen Red-tailed Hawk (*Buteo borealis*), 2 American Sparrow-hawks (*Falco sparverius*), and 1 Meadow lark (*Sturnella magna*), in the flesh, from Sandy Spring, Md. (Gift; 3 accessions.)

From P. L. Jouy, Washington, D. C., 71 specimens (64 species), from various localities in United States. (Exchange.) 11 specimens (6 species), from Sonora, Mexico, and 11 specimens (6 species) from Arizona. (Collected for the Museum.) 55 specimens (33 species) from San Luis Potosi, Mexico. (Collected for the Museum.)

From Peter Lepp, East Saginaw Mich., 5 specimens (5 species) of owls. (Exchange.) 3 specimens Screech Owl (*Megascops asio*). (Exchange.)

From George A. Lewis, Wickford, R. I., 1 female American Eider (*Somateria dresseri*), in the flesh, from Rhode Island. (Gift.)

From C. Littlejohn, Redwood City, Cal., 2 specimens, same number of species, from California. (Gift.)

From Leverett M. Loomis, American Museum Natural History, New York City, N. Y., 9 specimens Mountain Solitary Vireo (*Vireo solitarius alticola*), from Cæsar's Head, South Carolina. (Gift.) 20 specimens (6 species), from Cæsar's Head, South Carolina. (Gift.)

From A. W. Lord, Jacksonville, Ill., 18 specimens (11 species), from Illinois. (Exchange for publications.) 14 specimens (10 species) from Illinois. (Exchange for publications.) 9 specimens (6 species) from Illinois. (In exchange for publications.)

From Dr. E. A. Mearns, U. S. Army, Fort Snelling, Minn., 140 specimens (78 species), from Minnesota. (Gift.)

From Dr. E. A. Mearns, U. S. Army (through International Boundary Commission), 101 specimens (30 species), chiefly from El Paso, Tex.

From T. C. Mendenhall, Superintendent U. S. Coast and Geodetic Survey, 13 specimens (same number of species), from Alaska.

From G. Frean Morcom, Chicago, Ill., 1 Cackling Goose (*Branta minima*), in the flesh, from Minnesota. (Gift.)

From the Museo Nacional de Costa Rica, San José, Costa Rica (through George K. Cherrie), type specimens of *Mionectes semischistaceus* Cherrie, and *Ornithion subflavum* Cherrie, new species. (Gift.) 4 specimens (2 species, both new to science). (Gift.)

From National Zoölogical Park, Washington, D. C., 3 specimens (in flesh) of Scarlet Ibis (*Guara rubra*). (Gift.)

From Ralph N. Norton, Westbrook, Me., 7 specimens Red and White-winged Crossbills (*Loxia curvirostra minor* and *L. leucoptera*), from Westbrook, Me. (Exchange for publications.)

From J. T. Park, Warner, Tenn., 4 skins of the bronzed Grackle (*Quiscalus æneus*), from Warner, Tenn.; important as showing that this form, and not *Q. quiscula*, breeds in that section. (Gift.)

From A. H. Parker, Westbrook, Me., 4 specimens (3 species), from Goshen and Westbrook, Me. (Exchange for publications.)

From William Palmer, National Museum, 1 specimen Jendaya Paroquet (*Conurus jendaya*), from Brazil. (Exchange.)

From C. E. Pleas, Clinton, Ark., 12 specimens (10 species), mounted birds, from Arkansas. (Exchange for publications.)

From A. G. Prill, Sweet Home, Oregon, 1 Cooper's Hawk, downy young, from Oregon. (Gift.)

From Dr. Wm. L. Ralph, Utica, N. Y., 1 skin of Flammulated Screech Owl (*Megascops flammeolus*) and 2 skins of Saw-whet Owl (*Nyctala acadica*), from Colorado; parents of eggs presented by Dr. Ralph to the oölogical collection of the Museum (gift; purchased for the Museum by Dr. Ralph); 14 specimens (11 species), from Florida. (Gift.)

From Jenness Richardson, New York City, 8 specimens Carolina Paroquet (*Conurus carolinensis*). (Purchased for World's Fair exhibit.)

From C. W. Richmond, Bluefields, Nicaragua, 217 specimens (114 species), from vicinity of Greytown, Nicaragua, and Rio Frio, Costa Rica. (Purchased.) 13 specimens (3 species), from various localities. (Gift.) Three thousand (3,000) specimens (331 species), from the District of Columbia, Montana, California, Texas, etc. (Purchased.) 6 specimens (6 species), birds from District of Columbia and Maryland. (Gift.) 11 specimens hawks and owls, in the flesh, from Sandy Spring, Md., two accessions. (Gifts.)

From R. Ridgway, curator department of birds, U. S. National Museum, 29 specimens (17 species) bird skins, from various localities in Eastern United States—a selected lot, all the specimens showing unusual variations of plumage. (Gift.) One young (half-grown) Turkey Buzzard, from Washington, D. C.; 1 Downy Woodpecker, from Wheatland, Ind., and 1 Yellow-bellied Sapsucker, from Laurel, Md. (Gift.)

From C. B. Riker, New York City, 399 specimens (228 species), from the Lower Amazon. A specially important collection, containing a large number of types of species described in the "Proceedings" of the National Museum (Vol. x, pp. 516-528), and 28 species previously unrepresented in the Museum's collections. (Purchased).[*]

From Frank Robinette, Washington, D. C., 45 specimens (13 species), from Chihuahua, Mexico. (Purchased.) 5 specimens (same number of species), from Chihuahua, Mexico. (Gift.)

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[*] Purchased in June, but owing to part not being received, collection was not entered till July.

From Jos. Rosenthal, New York City, 4 specimens (4 species) birds of Paradise, etc. (Purchased.)

From Fred Sauter, New York City, 6 specimens (6 species) humming birds, from Ecuador. (Purchased for World's Fair exhibit.)

From Edw. S. Schmid, Washington, D. C., African Gray Parrot (*Psittacus erythacus*) and 1 Festive Parrot (*Amazona festiva*), in the flesh; the latter (from South America) new to the collection; two accessions. (Gift.)

From the Science College Museum, Tokio, Japan (through M. M. Kikuchi), 2 specimens of the Japanese Ptarmigan, new to the collection. (Gift.)

From Dr. R. W. Shufeldt, Takoma, D. C., 1 specimen Wilson's Snipe (*Gallinago delicata*), from Fort Wingate, N. Mex. (Gift.)

From Wm. G. Smith, Loveland, Colo., 2 specimens Dusky Grouse (*Dendragopus obscurus*) and 1 of White-tailed Ptarmigan (*Lagopus leucurus*), from Colorado. (Purchased for World's Fair exhibit.)

From Southwick & Critchley, Providence, R. I., 3 specimens American game birds. (Purchased for World's Fair exhibit.)

From Harold B. Stabler, Sandy Springs, Md., 4 specimens (3 species) hawks and owls in the flesh. (Gift.)

From Dr. L. Stejneger, curator department of reptiles, U. S. National Museum, 40 specimens (16 species) bird skins, from various parts of the world, including 26 specimens and 6 species of the genus *Sitta*. (Gift.)

From R. C. Stuart, Tampa, Fla., 1 male Ivory-billed Woodpecker (*Campephilus principalis*). (Purchased for World's Fair exhibit.)

From Rev. H. B. Tristram, The College, Durham, England, 53 specimens (47 species), chiefly from New Guinea, New Caledonia, New Hebrides, &c. (Exchange).

From B. P. Watrous, Washington, D. C., 4 specimens Wild Turkey (*Meleagris gallopavo*) in the flesh. (Purchased for World's Fair exhibit.)

From Arthur T. Wayne, Old Town, Fla., 2 specimens Swallow-tailed Kite (*Elanoides forficatus*). One specimen presented to Museum, one purchased for World's Fair exhibit.

From Harry Gordon White, Washington, D. C., 2 specimens (2 species) hawks, from Virginia. (Gift.)

From R. S. Williams, Great Falls, Montana, a pair of Western Flycatchers (*Empidonax difficilis*), from Belt River Cañon, Montana; parents of nest and eggs purchased for oölogical collection. (Gift.)

From Scott B. Wilson, Heatherbank, England, 1 specimen Baillon's Grosbeak (*Loxioides bailloni*), from Hawaii. (Purchased.)

From the U. S. Fish Commission, Washington, D. C. (through Col. Marshall McDonald, Commissioner), 117 specimens (20 species), from the Galapagos Archipelago, collected by Mr. Chas. H. Townsend. Twenty-seven specimens (20 species), chiefly from Alaska.

ROUTINE WORK.

A considerable part of what might properly be included under this heading has been already mentioned.

The number of specimens mounted during the year (exclusive of those mounted for the World's Fair exhibit) is 276, and of specimens made into skins, 33. These totals are less than for the year 1890–'91, for the reason that a considerable portion of the taxidermist's (Mr. Marshall's) time was devoted to work on the World's Fair exhibit.

The following minor routine work was performed during 1891–'92:

Official letters written		486
Official memoranda written		213
Orders for work		62
Requisitions (house)		97
Requisitions (outside)		130
Memoranda of packing		18
Monthly reports	pages	72
Papers for publication written and turned in	do	67
Invoices of specimens distributed	do	30¾
Proof corrected	do	407¾
Proof corrected, galleys	do	95½
Manuscript revised	do	3
Annual report for 1890–'91 written	do	37

SPECIAL RESEARCHES.

Under this heading may be mentioned chiefly the curator's work upon collections from Honduras, Costa Rica, the Galapagos Archipelago, Cashmir, etc., and upon special groups, as the genus *Formicarius;* Dr. Stejneger's upon collections from Japan and the Sandwich Islands; Mr. J. A. Allen's on the genus *Colaptes*, and Mr. Frank M. Chapman's upon the Genus *Quiscalus*. Some of these investigations have not been concluded; but the results of others have been published. (See Bibliography, Section IV.)

PRESENT STATE OF THE COLLECTION.

The present state of the collection is considerably imprôved over that of last year, owing to the far more convenient arrangement of the larger part in modern cabinets. A considerable portion (much the bulkier part, though numerically less) has yet to be rearranged, the work having been retarded by the preparation of the World's Fair exhibit as well as by want of cases. It will, however, be resumed at as early a date as possible, and it is to be hoped that by the end of the current year the entire study collection may be put in a thoroughly systematic state, and the duplicates separated and classified, so that by next year an extensive distribution of sets can be made.

The number of specimens contained in the collection at the end of June, 1892, is shown in the following table:

	1890–'91.	1891–'92.	Increase.
Study series	49,995	53,624	3,629
Exhibition series	*7,403	*7,884	481
Duplicate series	5,808	6,908	1,500
Total	62.806	68,416	5,610

* Number ascertained by actual count.

The last entry in the catalogue for June, 1891, is 120752; that for June, 1892, is 126361.

REPORT ON THE DEPARTMENT OF OÖLOGY IN THE U. S. NATIONAL MUSEUM, 1892.

By CHARLES E. BENDIRE, U. S. Army (retired), *Honorary Curator.*

I am pleased to be able to state that the collection is now in excellent shape, easy of access, and reasonably safe from insects and vermin. During the past year thirty new quarter unit zinc-lined and insect-proof cases have been furnished for its accommodation, and the entire collection has been carefully overhauled, rearranged, and relabeled. The majority of the specimens now on hand in the reserve collection are in an excellent state of preservation, and as at present cared for will remain so.

The exhibit of nests and eggs in the main hall of the Smithsonian Institution could now be materially increased, if more room was available for this purpose.

The most important contributions to the collection during the year are as follows:

Dr. Wm. L. Ralph, 26 Court street, Utica, N. Y., a magnificent collection, consisting of 444 sets of eggs, representing 194 species and 1,630 specimens. Among these are several species new to the collection; many others are very rare and have been especial desiderata for years, and all are beautifully prepared. Accompanying these eggs are 100 nests, also in an excellent state of preservation. This collection is by far the most valuable gift received since I have been in charge of the department.

Mr. R. MacFarlane, chief factor, Hudson Bay Company, Cumberland House, Saskatchewan, Canada, an interesting collection of 59 sets of eggs represented by 225 specimens and 30 nests. This donation is of considerable scientific value, as it extends the breeding range of several species considerably to the northward.

U. S. Department of Agriculture, Washington, D. C., a valuable collection, consisting of 40 sets, 113 specimens, and 17 nests, from the Death Valley region in southern California, Nevada, and Utah, and containing a number of rare specimens.

Interesting accessions have also been received as follows:

Mr. Guy E. Mitchell, Washington, D. C., a local collection, consisting of 59 sets and 239 specimens.

Mr. Walter F. Webb, Geneva, N. Y., 39 sets, numbering 137 specimens and 10 nests.

Assist. Surg. Edgar A. Mearns, U. S. Army, Fort Snelling, Minn., 46 sets, numbering 177 specimens and 20 nests.

U. S. Fish Commission (Washington, D. C.), 9 sets, 29 specimens, and 2 nests.

Mr. Charles Littlejohn, Redwood City, Cal., 21 sets, 42 specimens, and 1 nest.

Mr. H. P. Attwater, Rockport, Aransas County, Tex., 11 sets, 56 eggs, and 3 nests.

Mr. Frank Robinette, Washington, D. C., 17 sets, 42 eggs, and 2 nests.
Mr. Thad. Surber, White Sulphur Springs, W. Va., 13 sets, 52 eggs.
Mr. W. G. Smith, Loveland, Colo., 7 sets, 23 eggs, and 7 nests.
Mr. Frank Everett, Washington, D. C., 9 eggs.
Dr. A. G. Prill, Sweet Home, Oregon, 2 sets, 10 eggs, and 1 nest.
Mr. R. S. Williams, Great Falls, Mont., 2 sets, 7 eggs, and 2 nests.
U. S. Coast and Geodetic Survey, Washington, D. C., 2 sets, 8 eggs, and 1 nest.
Mr. F. B. Pattee, Valley Springs, Calaveras County, Cal., 4 sets, 23 specimens.
Mr. P. L. Jouy, Washington, D. C., 3 sets, 16 specimens, and 1 nest.
Dr. Loverett M. Loomis, Chester, S. C., 4 sets, 12 specimens.
Mr. R. H. Kirby Smith, Sewanee, Tenn., 5 specimens.
Mr. Fred. Fowler, Fort Huachuca, Ariz., 2 specimens.
Mr. W. B. Porter, Chicago, Ill., 6 specimens.
Lieut. Harry C. Benson, Fourth Cavalry, U. S. Army, Presidio of San Francisco, Cal., 6 sets, 13 specimens, and 3 nests.
Capt. Charles E. Bendire, Washington, D. C., 3 specimens.
Mr. H. H. Phillips, Crystal Falls, Mich., 1 specimen.
In addition to these donations 37 specimens, representing 7 species, were purchased during the year.

The routine work has consisted in recording, marking, measuring, and arranging 2,919 specimens received during the year, and placing them in their proper order in the reserve collection. Also revising and rearranging in numerical order 382 register sheets, showing the present status of the collection, and overhauling and rearranging the collection of nests.

The curator has also been engaged in reading proof of Vol. I, Life Histories of North American Birds, etc., compiling the index for this volume, and in gathering material for another volume. Twenty-nine lots of eggs sent for identification have been reported on.

PRESENT STATE OF THE COLLECTION.

Specimens in North American series (representing 771 species and subspecies)	34,700
Specimens in North American series, duplicates	11,759
On exhibition	1,491
Total	47,950
Specimens in foreign series (representing 611 species)	4,330
Specimens in foreign series, duplicates	231
Total	4,561
Nests in North American reserve series	2,539
On exhibition	235
Worthless and destroyed	25
Total number of nests now in the collection	2,799

The last catalogue entry made in June, 1891, was 24336, and in June, 1892, 25176.

REPORT ON THE DEPARTMENT OF REPTILES AND BATRACHIANS IN THE U. S. NATIONAL MUSEUM, 1892.

By LEONHARD STEJNEGER, *Curator.*

The herpetological department has every reason to look upon the year 1891–'92 with satisfaction. The number of accessions was larger than during any previous year, 1,055 specimens having been entered,* and the material was not inferior, nor were the collections of less interest. Several very interesting species were added to the collection, some very rare or for the first time, others hitherto undescribed. Among the latter I would call special attention to a very remarkable blind cave salamander, discovered by Mr. F. A. Sampson in the Rock House Cave, Missouri, and described by me as *Typhlotriton spelæus*. It is related to *Desmognathus*, but its eyes, by disuse, have become non-functional; the eyelids closed over and grew together, and now there is only a shallow furrow and a dark spot left to designate externally the place of the eye. The *Proteus*, from the grottoes in Kaernthen, Austria, is the only other batrachian hitherto known to be blind in the same way, but it belongs to a different order, and *Typhlotriton* is so far the only known blind salamander. Of rare species I may mention a fine specimen of *Plethodon æneus*, from South Pittsburg, Tenn., transmitted by Mr. R. Morton Middleton, and several specimens of another salamander recently described, viz, *Spelerpes maculicaudus*, received from Dr. O. P. Hay, and from Messrs. Frederick C. Test and George E. Harris. The principal accessions will, however, be referred to further on.

The work in the department has consisted chiefly of routine work, installing, identifying, caring for, labeling, and reporting upon collections as they have arrived. The curator has attempted some work upon certain groups and upon the geographical distribution of the reptiles in the southwestern portion of the country, but a consistent and steady systematic work has been out of the question.

At the beginning of the last fiscal year it was decided to take up the many collections received during the last ten years and stored in bulk. As soon as jars and alcohol had been provided, the work of assorting and labeling was begun, and has continued steadily at such times as could be spared from the daily routine work. The work is slow, involving, as it does, not only the labor of handling, consulting the records, labeling, and card-cataloguing, but also a great deal of identifying.

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* For comparison it may be mentioned that the number of entries in 1890–'91 was 908; in 1889–'90, 705; in 1888–'89, 784; in 1887–'88, 19; in 1886–'87, 138.

Some time has been spent in preparations for a herpetological display at the World's Columbian Exposition. Thanks to Mr. Benedict's experiments, a plastic and pliable substitute for plaster was obtained for making the casts of reptiles and batrachians.

By far the most valuable and interesting collection, not only of the year, but since the Wheeler Survey west of the one hundredth meridian in the seventies, and ranking with those of the famous old exploring expeditions in the West, is the material received from Dr. C. Hart Merriam, through the United States Department of Agriculture, and collected by him and his parties during the so-called "Death Valley Expedition," 1891. It consists of more than 900 specimens (only a small portion, however, having been entered on the register before the end of the year), chiefly from the desert regions of California and Nevada, but many also from Utah, and quite a number from the great interior basin of California. A special report upon this collection has been prepared by the curator.

In addition to the collections mentioned in last year's report, as made by Mr. P. L. Jouy in southern Arizona, quite a number of specimens were received from him during the present fiscal year. The excellent quality of his collections and of his field observations are quite as marked in the latter as in the former.

From the same source the Museum procured the only extra-limital collection worth mentioning, viz, a number of reptiles and batrachians collected by Mr. Jouy during his stay in Korea several years ago. Very little is known of the herpetology of that rather inaccessible country, and the collection is therefore one of unusual interest.

The type specimen of *Typhlotriton spelæus*, the blind cave salamander, presented by Mr. F. A. Sampson, of Sedalia, Mo., has already been mentioned, but I may add that we are indebted to Mr. George E. Harris, of Cassville, Mo., for numerous larvæ of the same interesting species.

Many other valuable and interesting species have been received during the year from various correspondents, which can not be enumerated in detail in the present connection, but among the more prominent contributors the following deserve mention: Herbert Brown, Tucson, Ariz.; Prof. B. W. Evermann, through U. S. Fish Commission; J. D. Figgins, Washington, D. C.; Dr. O. P. Hay, Irvington, Ind.; H. W. Henshaw, Washington, D. C.; Julius Hurter, St. Louis, Mo.; R. Morton Middleton, South Pittsburg, Tenn.; Charles W. Richmond, Washington, D. C.; N. P. Scudder, Linden, Md.; Edgar Storment, Tempe, Ariz.; Dr. Timothy E. Wilcox, U. S. A., Fort Huachuca, Ariz.

Facilities for studying the collections, so far as they were accessible, have been extended to several gentlemen not connected with the Museum. Dr. O. P. Hay spent more than a month in the department studying the reptiles of Indiana. Dr. G. Baur, of Clark University, Worcester, Mass., spent considerable time at the Museum working up the collection of chelonians for his proposed work on the tortoises of North America, to be published by the Museum.

The work on the proposed supplementary volume of the "Nomenclator Zoologicus" has advanced satisfactorily. The genera and subgenera recorded in the Zoölogical Records for 1879–1889 have been card-catalogued during the year, and the work of indexing the additional names contained in the Zoologische Jahresberichte has been commenced.

Mr. Frederick C. Test has been employed as an aid to the department during the entire year. One half of his time has been devoted to work on the Nomenclator Zoologicus, the other half chiefly to routine work in the department.

During the year that part of the Museum collection which was brought home by the naturalists of the U. S. Fish Commission steamer *Albatross* from the Galapagos Islands was recalled from Prof. Cope. A large quantity of material is, however, still in his possession, and an accurate census of the herpetological specimens of the Museum is therefore as impracticable as it was last year. Like that presented a year ago, the following estimate has been prepared in this way: taking last year's estimate as a basis, those specimens which have been disposed of by exchange, or otherwise, have been deducted, and those which have been catalogued during the fiscal year have been added. Such an estimate shows the status of the collection on June 30, 1892, to be as follows:

	Specimens.
Reserve series	15,921
Duplicate series	8,705
Unassorted and exotics	6,313
Total	30,939

The last catalogue entry in June, 1891, was No. 17136 and the last entry in June, 1892, is No. 18191.

REPORT ON THE DEPARTMENT OF FISHES IN THE U. S. NATIONAL MUSEUM, 1892.

By TARLETON H. BEAN, *Honorary Curator.*

The work accomplished in this department has been in many respects generally similar to that of preceding years. My own duties in connection with the U. S. Fish Commission have rendered it impossible for me to devote much time to Museum matters, and the routine work of the department has devolved almost entirely upon Mr. Barton A. Bean, assistant curator.

The curator has assisted Dr. Goode in the preparation of a bulletin upon the deep-sea fishes contained in the U. S. National Museum, and the work was pushed rapidly forward during the fall of 1891.

Several hundred skeletons of fishes were prepared for the department by Mr. E. E. Howell. These have been turned over to Dr. Theodore Gill, temporarily, for study.

There has been a marked increase in the number of letters received through the Assistant Secretary's office. These for the most part contain queries concerning the fishes of various portions of the country, and the questions as a rule have been promptly answered. Others bring information of much importance concerning fishes and their life histories. Intelligent correspondents are much desired, and the policy of encouragement to such is strongly recommended.

A number of students examined materials belonging to the Museum (Drs. Gill, Jordan, Gilbert, Eigenmann, Smith, and Profs. Evermann, Hay, and others). Collections and papers based upon the same were received from numerous correspondents, a list of which will be found in the Bibliography (Section IV).

Quite a large number of drawings of deep-sea fishes have been made by Mr. A. H. Baldwin. An important addition to the sectional library was made by the purchase of four volumes of Dr. Bleeker's "Atlas Ichthyologique," which completes the set of that work.

The explorations here referred to resulted in the addition of important collections of fishes for the National Museum:

The U. S. Fish Commission steamer *Albatross* cruised in the North Pacific and Bering Sea during the summer of 1891 and the spring of 1892. During the winter of 1891 and 1892 the vessel was engaged in the survey of a cable route from California to the Sandwich Islands. On these cruises collections of fishes were made.

The steamer *Fish Hawk* was engaged in the lower Chesapeake Bay, where small collections were obtained.

The schooner *Grampus* did general collecting in the lower Chesapeake and in the coast waters adjacent thereto.

Prof. B. W. Evermann, for the U. S. Fish Commission, collected fishes in Montana and Wyoming during July and August, 1891.

Profs. J. T. Scovell and A. J. Woolman made some collections in northern Mexico during August, 1891. Mr. P. L. Jouy collected in Mexico (Lake Chapala, principally), in February and April, 1892.

Mr. Charles W. Richmond sent from Nicaragua collections made in February, March and April, 1892.

The total number of packages sent out during the year, not including the sets of duplicate fishes, was twenty-four. The most important were:

Thirty-seven species of deep-sea fishes to the Royal Museum of Copenhagen, Denmark, in exchange; a large series of fishes to be skeletonized; and seven species of Scopelids and a tile-fish to the Museum of Comparative Zoölogy at Cambridge, Mass.

Fifty-five sets of duplicate fishes were prepared and turned over to the registrar. The specimens were all carefully wrapped, and each set contained about 125 species, both fresh and salt water forms. A list to accompany each set was printed.

The number of specimens added to the collections of fishes during the year was 1,906. The first entry in the register was No. 43603, the last 44156, making a total of 553 entries.

The following list comprises the accessions to the department of fishes received during the year:

A small collection of fishes, made in Arizona by P. L. Jouy. 24582.

Two specimens of the shark-pilot, *Echeneis naucrates*. From Wrightsville Sound, North Carolina. 24625.

One specimen of *Argentina silus*. From H. P. Thompson, Belfast, Me. 24684.

Two specimens of sculpin, *Cottus richardsoni* var., from Arkansas. Received from F. A. Sampson, Sedalia, Mo. 24685.

Small collection of fishes, made at Guaymas, Mex., by P. L. Jouy. 24686.

Upper jawbone of *Lepidosteus platystomus* from strata of rock at Rocky Point, La. From S. B. Johnson, Shreveport, La. 24704.

One specimen of *Chirolophus polyactocephalus* in alcohol. From Ashdown Green, Victoria, British Columbia. 24711.

Twenty-one fine specimens of lancelets, *Branchiostoma lanceolatum*, from San Diego Bay, Cal. Purchased from L. C. Bragg. 24728.

Small collection of fishes from Mexico. Collected by Prof. A. Dugès. 24727.

A small collection from Matsoronga, Cordova, Estado Vera Cruz. From A. L. Herrera. 24769.

A small collection of fishes from the West Indies and the west coast of South America. Collected by Dr. Howard E. Ames, of the U. S. Navy. 24892.

Head and tail of *Salmo salar*, from the Cabbassacontic River, Maine. Sent by John T. Richards through Forest and Stream of New York. 25170.

One specimen of *Chilomycterus californiensis* (new species), from San Diego Bay. Purchased from L. C. Bragg. 25173.

A small collection of fishes, from the west coast of Florida, made by J. C. Henderson, jr. and Charles T. Simpson. 25300.

One fresh specimen of squirrel fish, *Serranus fascicularis*. From John Sutherland, New York. 25305.

Small collection from the District of Columbia and Virginia. Received from H. W. Henshaw. 25322.

One black-nosed dace, *Rhinichthys atronasus*, from the hot springs at Banff, in the National Park of Canada. Received from Henry M. Ami for identification. 25326.

One specimen of the Cascadura, *Hoplosternum littorale*. Procured by Roger Wells, U. S. Navy, on the island of Trinidad. 25336.

Three fresh fishes from the Washington, D. C., market. From F. H. Javins. 25367.

Numerous specimens of dried fish skins from Japan. Sent by H. Loomis, Clifton Springs, N. Y. 25379.

One large example of flounder, *Pseudopleuronectes americanus*, taken in the beam trawl in deep water off the New England coast. From Weaver and Ihl, New York. 25389.

A collection of fishes from Fort Snelling, Minn. From Dr. E. A. Mearns, U. S. A. 25392.

Two fishes from Fort Huachuca, Ariz. Sent by Dr. T. E. Wilcox, U. S. Army. 25401.

Three fresh fishes from the Gulf of Mexico. Sent by Bartholomew & Co., New Orleans, La. 25405.

One specimen of *Anoplarchus*. Collected by J. E. McGrath in South Alaska. 25431.

A collection of fishes from Montana, Wyoming, and the Yellowstone Park, made by B. W. Evermann. 25434.

Eight specimens of *Rhinichthys nasutus*, from the warm and cold springs of the National Park of Canada. Sent by Henry M. Ami, of Ottawa, for identification. 25440.

One specimen of *Achirus lineatus* and one specimen of *Cyclopsetta* n. sp. Collected by Dr. John F. Chittenden of the Victoria Institute, Trinidad, West Indies. 25537.

Pike's eye with fungus attached. Sent by Harlan I. Smith, of Saginaw, Mich., for examination. 25606.

Two dried sea-horses, *Hippocampus hudsonius*. Sent by J. J. Dunton from Ocean City, Md. 25640.

One specimen of *Azeria panamensis*, in exchange, from the Museum of Comparative Zoölogy. 25687.

One fresh specimen of *Prionotus carolinus*. Javins & Co., Washington, D. C. 25710.

One dried specimen of *Monacanthus hispidus*. Sent by C. A. D. Hill, of Pensacola, Fla. 25717.

One specimen of *Larimus fasciatus*, from Chesapeake Bay. Donated by Walter Moreland. 25742.

One specimen of *Chilomycterus geometricus*. Donated by Douglas Taylor. 25770.

One fresh specimen of *Amia calva*, from the Niagara River. Sent by V. L. Tiphaine, of Lewiston, N. Y., through Forest and Stream. 25788.

One specimen of *Ctenolabrus adspersus*, from the Lower Potomac. Donated by Walter Moreland. 25794.

Collections of fishes from the Northwest Branch, Maryland, and from Four Mile Run, Virginia. Donated by Audubon Ridgway. 25822.

Small collection of fishes from Mexico. Collected by J. T. Scovell and A. J. Woolman. 25859.

SPECIMENS SENT FOR EXAMINATION AND REPORT.

Scales of the gar-pike. Received from J. D. Lucas, Marion, S. C. (No. 1275.)

Egg-case of shark, *Gyropleurodus francisci*. From E. Staples, jr., Riverside, Cal. (No. 1583.)

A small collection of fishes, made in Honduras in 1892, by C. W. Richmond. (No. 1692.)

REPORT ON THE DEPARTMENT OF MOLLUSKS

(INCLUDING CENOZOIC FOSSILS)

IN THE U. S. NATIONAL MUSEUM, 1892.

By WILLIAM H. DALL, *Honorary Curator.*

The force of the Department of Mollusks during the past year has comprised, besides the honorary curator, Mr. Charles Torrey Simpson, aid, Mr. S. Hazen Bond, copyist, and Miss N. C. Beard, copyist. Dr. R. E. C. Stearns, of the U. S. Geological Survey, honorary adjunct curator, has been absent on sick leave during nearly the whole year, so that we have not had the advantage of his valuable aid and advice in the work of the department. The three persons mentioned above have comprised the salaried force of the department. Mr. Gilbert D. Harris and Mr. Frank Burns, of the U. S. Geological Survey, in the course of their work on the tertiary invertebrate fossils, have rendered incidental assistance on that part of the collection. The writer, with the permission of the Director of the U. S. Geological Survey, has continued to act as honorary curator.

The members of the force have been diligent, faithful, and accurate in their work, and Mr. Simpson especially has devoted much time outside of ordinary office hours to forwarding the work of the department and assisting its numerous correspondents.

GENERAL OPERATIONS.

The routine work of the year has made considerable progress. The number of registrations which are tabulated in another place in this report is less numerous than for some years previous, because more time has been devoted to putting the collection of duplicates in order and to other matters set forth below. As the arrears of material not administered upon have been reduced, the number of duplicates has increased, and it has for some time been obvious that in order to make the exchanges often called for, and to keep informed as to the state of duplicate material, it was urgently required that the latter should be put in order for reference. Much of the time of Mr. Simpson and Mr. Bond has been devoted to sorting, naming, cataloguing, and putting away the duplicate shells in numbered boxes. A large proportion of the duplicates is now packed in small boxes in the storage-room, each bearing its catalogue number, the last box entry being No. 2035, while a card-catalogue, alphabetically arranged under the names of the species, makes it possible to refer at a moment's notice to any duplicates in the collection. Some few marine collections remain to be reviewed and the duplicates eliminated, but the great mass of duplicate recent and fossil shells are now arranged in orderly and accessible condition, occupying over 1,700 boxes, each plainly marked with its registration number and name.

The drawings, published and unpublished, are becoming so numerous that here also cataloguing and arrangement have become necessary. A list,in the form of a card-catalogue, had been made of all the woodcuts and stereotypes of mollusks illustrated in the Smithsonian Reports and in the Proceedings and Bulletins of the Museum (with certain exceptions). Stout manilla envelopes, of the same size as the standard library card, have been used to contain original drawings, whether published or unpublished, while in a blank form, stamped on the outside of the envelope, is noted the catalogue number of the drawing, the registration number (in the Museum register), name, and provenance of the specimen from which the drawing was made, together with the publication, volume, plate, figure, number, and page reference of the engraving made from the drawing, if published. The latter data are entered on library cards in cases where the engraving exists, but the drawing is not extant. These cards and envelopes are arranged together alphabetically under the name of the species, in two series, one comprising the published and the other the unpublished drawings, so that reference can be had immediately to the data relating to any species which have been drawn, or of which a figure has been published in the publications of the Museum or of the Smithsonian Institution. The exceptions to this comprise the figures which have appeared in Bulletin 37, U. S. National Museum, which contains over a thousand figures; those figures which are contained in the series of Smithsonian manuals of land and fresh-water shells in the Miscellaneous Collections of the Institution, and a set of stereotype figures derived from the British Museum publications. As the cuts above named are indexed in the publications referred to, and thus easily reached, it was not thought worth while to undertake the considerable labor of adding them to the catalogue until other more pressing matters are out of the way.

The amount of labor involved in these various directions can be better appreciated if placed in tabular form as follows:

Species of duplicates registered	1,708
Card-catalogue of the same	1,708
Drawings registered	576
Envelopes for the same filled out	576
Cards cataloguing published figures	603
Total entries	5,171

It will be observed that this is equal to 5,171 registrations, so far as the clerical labor is concerned, and if we add to it the regular entries for the year in the Museum Register, we have a total of about 7,700 entries as against about 5,800 for 1890–'91. As the staff, by reason of Dr. Stearns' absence was diminished by one person, the equivalent at the lowest estimate of 25 per cent of its efficiency, this record may be regarded as satisfactory.

Besides the work above referred to, the general operations of the department comprise the preparation of special reports on collections made under governmental auspices by various organizations, such as the Fish Commission, the Navy, the Revenue Marine, the Agricultural Department, and special expeditions. In this line various papers have been printed by the writer and other members of the staff, a reference to which will be found in the Bibliography (Section IV). Among them is a paper forming Part G of Bulletin 39 of the U.S. National Museum, containing instructions for collecting and preserving mollusks, notes on the arrangement, outfit, and cataloguing of collections, and the construction of dredges. This it is thought will be of use to collectors beginning work on the Mollusca, and will save much clerical work in writing out such instructions at short notice, as has been required frequently in the past on the starting of expeditions undertaking natural history work.

ACCESSIONS.

The number of accesssions during 1891–'92 was 85, against 79 in 1890–'91. Several of them comprised large series of valuable and interesting forms, many of which are new to the collection. Among the most interesting the following may be noted:

From Mr. C. F. Ancey were received a number of rare and peculiar species from Africa, including several of the forms found only in the south African Lake Tanganyika.

Mr. W. G. Binney presented the blocks of figures used in his publications of the past two years, thus making them available for use in future publications of the Museum.

Mr. R. W. Brown, of Washington, has continued to present to the Museum the numerous land-snails, etc., which are found from time to time in his importations of foreign fruit, so that we have had the opportunity of observing in a living state in an improvised snailery, several of the peculiar types of Antillean pulmonates.

The heirs of the late Oliver N. Bryan, of Marshall Hall, Md., in accordance with his wish presented his collection of fossils, Indian relics, etc., to the National Museum, by which quite a number of fine and interesting fossil mollusks fell to the share of this department.

To Dr. J. C. Cox, of Sydney, New South Wales, through Mr. Charles Hedley of the Australian museum, we are indebted for alcoholic specimens of the remarkable *Ephippodonta Macdougallii* Tate, a bivalve related to *Galeomma* and on which an investigation of its anatomy may be based.

Through Mr. Hugh Fulton, of London, by exchange and purchase a number of rarities not otherwise obtainable have been received, including a fine specimen of the extremely rare *Voluta aulica* which formerly belonged to the Barclay collection.

From Mr. I. Greegor, of Jacksonville, Fla., a number of interesting specimens have been received, mostly from Florida and the Antilles.

Mr. Simpson, of the department of mollusks, joined Mr. J. B. Henderson, jr., on an expedition to the west coast of Florida, which proved fruitful in results. A series of the specimens collected, so far as they might be useful to the Museum, was presented by Mr. Henderson.

Two large series of Japanese mollusks have been received during the year. These accessions greatly enrich that department of the collection, each containing several rarities which were not comprised in the other. One of these was the gift of the Rev. H. Loomis, of Yokohama, and the other was received in exchange for other specimens sent to Frederick Stearns, esq., of Detroit, Mich., who supplemented it by other forms from Mauritius and the Hawaiian Islands.

Another gift which is highly appreciated was a set of several hundred species from St. Helena, probably illustrating the whole of its mollusk fauna, including the curious extinct land shells. This very interesting contribution was received from Capt. W. H. Turton, of the Royal Engineers, Chatham, England. The collection of which this is a representative set was reported on at length by Mr. E. A. Smith, of the British Museum.

The extinct fresh-water mollusk fauna of the Colorado desert has always been of great interest. One by one the species have been found living in springs, to which they retreated on the desiccation of the ancient lake. One alone remained to be discovered, *Tryonia clathrata* of Stimpson; and among the collections of the expedition to Death Valley made by Dr. C. Hart Merriam under the auspices of the U. S. Department of Agriculture this has been at last secured, living in a spring with a water temperature of 97° F. in the Pahranagat Valley. This is certainly one of the most interesting malacological events of the year.

Through the efforts of the Hon. Rounsevelle Wildman, United States consul at Singapore, a collection representing the chief marine forms of that vicinity was obtained from native collectors.

Mr. Joseph Willcox, of Philadelphia, has continued to contribute to the collection of Tertiary fossils, and has enriched it by a number of species from the Tertiaries of the Carolinas and Florida.

ASSISTANCE TO STUDENTS.

The work of assisting students in various parts of the country to identify their local faunæ, to intelligently direct their studies, and answer their numerous queries on various branches of the subject, has always been regarded as an important function of this department, and has been frequently referred to in the previous reports. Correspondence of this kind was kept up in 1890–'91 with 160 persons, involving over 300 letters and between 600 and 700 pages of writing, besides the identification of about 1,200 species of mollusks. In 1891–'92 the number of correspondents was 114, and the number of pages of writing involved in the correspondence 820. The number of species identified for various students, chiefly by Mr. Simpson, under my direction, amounts to considerably over 3,000, for each of which a label had to be written.

SPECIAL RESEARCHES.

A reference to the Bibliography (section IV) will indicate the direction of the studies carried on during the year. The report on the later Tertiary of the United States and Mr. Simpson's paper on Floridian

Unios, though printed, will be issued a few days too late to appear in the Bibliography of this year. The principal labor of the year has been bestowed on the continuation of the report on the Florida Tertiary Mollusks, for the Wagner Institute, of Philadelphia; preliminary work on the mollusks of the Galapagos trip of the U. S. Fish Commission steamer *Albatross*, and also those collected by Dr. G. Baur; and on the *Unionidæ*, to which group Mr. Simpson is giving special attention.

STATE OF THE COLLECTION.

In previous reports I have explained why it is not yet possible to give the exact number of species, specimens, duplicates, etc., contained in the collection under my charge. In my last report it was estimated that the collection contained about 476,500 specimens, of which one-fourth are preserved in alcohol. During the year about 6,225 specimens have been received, which would make a present total of about 482,725 specimens contained in the collection. The number of entries in the register for 1891–'92 was 2,546, as is shown in the accompanying table.

Volume.	From—	To—	Total.	Remarks.
XXIII	106,856	106,904	48	Volume in use.
XXIV	112,040	112,400	360	Reserved for fossils.
XXVI	122,524	124,662	2,138	Volume in use.
Total for 1891-'92			2,546	

The total number of registrations to date, deducting all duplications and omissions in the register, is 103,113, representing about 309,000 specimens. The number of workers and their distribution in different parts of the building renders it necessary to use simultaneously several volumes of the register. This explains why the preceding table is necessary in order to show the total registrations for the year. The formal registrations (with the gaps alluded to) terminates June 30, 1892, with number 124,662.

REPORT OF THE DEPARTMENT OF VERTEBRATE FOSSILS IN THE U. S. NATIONAL MUSEUM, 1892.

By O. C. Marsh, *Honorary Curator.*

The most important event in this department of the Museum during the past year has been the accession of a large collection of vertebrate fossils from the West, secured by the honorary curator during his official work for the U. S. Geological Survey. These specimens were prepared in New Haven, sent to the National Museum in July, 1891, and placed at once on exhibition, so as to be accessible to the members of the International Geological Congress, which met in Washington in August of that year. This collection of fossils, which is more extensive and important than any other hitherto received by the Museum, is arranged in a wall-case especially constructed for it, extending the entire length of the east side of the exhibition room.

These specimens, selected by the honorary curator as the first instalment of his official collections to be placed in the National Museum, are all of large size, and especially characteristic of three important geological horizons of the West. The ceratops beds of the upper Cretaceous of Wyoming are here represented by three skulls and other rare remains of the gigantic horned dinosaurs recently described, and among these fossils is the type of *Triceratops elatus* Marsh. From the Brontotherium beds of Nebraska and Dakota is shown a very complete series of skulls and portions of skeletons of the huge Miocene mammals of the family *Brontotheridæ.* This series contains ten good skulls representing several genera, and is by far the most important collection of the group ever placed on exhibition. The horizon of the Pliocene, known as the Pliohippus beds, is likewise represented by skulls and other remains of extinct species of the Rhinoceros family, especially of the genus *Aceratherium*, all from Phillips County, Kans. A few other Tertiary fossils and some rare casts are included in this collection, but the limited space available prevented the exhibition of a more extensive series.

This collection, when sent from New Haven in 33 boxes, weighed 6,860 pounds. It has now been catalogued and well arranged by Mr. F. A. Lucas, assistant curator, whose services in other respects have

REPORT ON THE DEPARTMENT OF INSECTS IN THE U. S. NATIONAL MUSEUM, 1892.

By C. V. RILEY, *Honorary Curator.*

Although most of the time during the past fiscal year has been devoted to the study collections in the laboratory, some improvements have been made in the exhibit collections, especially in the systematic series, where numerous illustrations and specimens have been added, making it almost complete.

ACCESSIONS.

Many important accessions have been received during the year, among which the following may be mentioned:

(1) One hundred and thirty-five species in about 400 specimens of Heteroptera, collected in various parts of the world, authoritatively named, from Prof. A. L. Montandon, Bucarest, Roumania (Acc. 24579, 25244, and 25520). These have in part been paid for by exchange.

(2) Series of Californian insects, collected by Mr. D. W. Coquillet, of Los Angeles, Cal., and transferred to the Museum collection by the curator, as follows: *Diptera*, 23 species in 182 specimens (Types); *Coleoptera*, about 100 species in 720 specimens; *Orthoptera*, 35 species in 116 specimens; *Hymenoptera*, 109 species in 400 specimens; *Homoptera*, 40 species in 200 specimens; *Hemiptera*, 107 species in 575 specimens; *Lepidoptera*, 56 species in 159 specimens; *Neuroptera*, 17 species in 43 specimens; includes much valuable material in all orders (Acc. 24628, 24816, 24890, 24950, 25005, 25111, 25356, 25400).

(3) From the Department of Agriculture: Collection of insects made by Mr. A. Koebele during the Death Valley Expedition from the Department of Agriculture in the spring of 1891. Contains about 636 species in 3,473 specimens. Good and excellently preserved material.

(4) Collection of Lepidoptera (native and exotic) from Mr. G. Beyer, of New York. Nine hundred species in about 1,900 specimens, nearly all large and showy forms, besides many North American and European species new to our collection. This is the largest acquisition of tropical butterflies ever made by the Museum. It was obtained by exchange for a corresponding number of North American Coleoptera from our duplicate series, that were new to Mr. Beyer's collection. This one and the previous accession are the most valuable during the year. (Acc. 25378.)

(5) Collection of Aculeate Hymenoptera, about 4,000 specimens of 675 North American species (including types of 25 species described by Mr. William Fox), and 100 exotic species from Mr. William Fox, Academy Natural Sciences, Philadelphia. Purchased by the Museum. (Acc. 25769.)

(6) Collection of insects of all orders, made by Mr. H. F. Wickham in the Northwestern States, British Columbia, and Alaska. About 1,20 ansferred to the Museum collection by the curator. (Acc. 25554.)

(7) Lepidotera from Trinidad, about 15,000 specimens r. G. Turner Wayman, Port-of-Spain, Trinidad. Purchased by t 335.)

(8) Twenty-seven species miscellaneous insects in about 200 specimens, mostly from Galapagos Islands, from the U. S. Fish Commission. (Acc. 25157.)

(9) Two hundred and twelve species of New Zealand Coleoptera in about 400 specimens, from Auckland Museum, New Zealand, from T. F. Cheeseman, intended for exchange. (Acc. 24957.)

(10) Sixty-six species of authoritatively named exotic Orthoptera from Prof. H. de Saussure, Musée d'Histoire Naturelle, Genève, Suisse. This collection was obtained by the curator and by him transferred to the Museum collection. (Acc. 25271.)

(11) Types of 16 species of Muscidæ, described by Prof. C. H. Tyler Townsend, Las Cruces, New Mexico, and some other insects from Prof. Townsend. (Acc. 25792.)

(12) Types of 3 new species of Odonata, from Mr. P. C. Calvert, Academy Natural Sciences, Philadelphia. (Acc. 25609.)

(13) Types of Scudder's articles on fossil insects in Hayden's report of U. S. Geological Survey, Vol. XIII, from Maj. J. W. Powell. (Acc. 24593.)

(14) From the curator, 100 species of Scolytidae, mostly exotic, including many types, from Dr. W. Eichhoff, Strasburg, Germany. (Acc. 25498.)

(15) Ten species in 42 specimens of Orthoptera, including some types, from Prof. L. Bruner, Lincoln, Nebr. (Acc. 24976.)

(16) Twenty-four species of North American Coleoptera, new to collection, collected by Mr. L. E. Ricksecker, San Diego, Cal., and transferred to the Museum collection by the curator. (Acc. 24940.)

(17) Two hundred specimens of various orders, collected in Texas by Mr. F. G. Schaupp, and transferred to the Museum collection by the curator. (Acc. 25110.)

(18) Twenty-four species of North American Coleoptera, new to collection, from Mr. F. C. Bowditch, Brookline, Mass. (Exchange.) (Acc. 25593.)

(19) Male specimens of *Dynastes granti* Horn from Mr. Ike Patrick, Crown King, Ariz. (Acc. 24915.)

Numerous valuable specimens have been added to the collections without accession numbers by the curator and his assistants.

As a temporary accession may be mentioned a large collection of West Indian Hemiptera and parasitic Hymenoptera, sent to the curator for systematic study by the West India Committee of the British Museum.

ROUTINE WORK.

This has consisted in—

(1) Making up collections for exchange, some of which are the following:

(*a*) A series of 57 species of Scolytidae for Dr. Wm. Eichhoff, Strasburg, Germany, in return for Acc. 25498.

(*b*) A series of 35 species of Scolytidæ for A. D. Hopkins, Morgantown, W. Va.

(*c*) A series of 900 species of Coleoptera for Mr. G. Beyer, New York, in return for Acc. 25378.

(*d*) A series of Hemiptera for Prof. A. L. Montandon, Bucharest, Roumania.

(*e*) A series of 24 species of Coleoptera for Mr. F. C. Bowditch, Brookline, Mass., in return for Acc. 25593.

(*f*) Sixty-nine species of Elateridæ for Mr. H. de Buysson, Chateau de Vernet, Allier, France.

(2) Reporting on accessions sent for examination and report. One hundred and seventy-two of these reports have been made during the year.

(3) The naming of specimens for collectors. Fifty-two larger and smaller series of insects of all orders have been identified for correspondents, representing about 3,000 species.

(4) The selection of material to be sent to specialists for study and determination, as here indicated:

(*a*) A series of Californian Hemiptera-Heteroptera has been sent to Prof. A. L. Montandon of Bucarest, Roumania.

(*b*) The material in the Noctuid genera Xylomiges and Cucullia was sent to Prof. J. B. Smith, New Brunswick, N. J., to assist him in his study of these groups.

(*c*) A series of Geometridæ, mostly collected in the Death Valley, California, was sent to Dr. A. S. Packard, of Providence, for determination.

(*d*) A small series of Diurnals was sent to Mr. W. H. Edwards for determination.

(*e*) Several smaller series and all the Odonata, collected by Dr. Abbott in Africa, have been sent to Dr. P. C. Calvert, Academy Natura Sciences, Philadelphia, for systematic study.

(*f*) A complete representation of the Museum collection in the Rhynchophorus Tribe Barini has been sent to Capt. T. L. Casey, New York, who has undertaken to monograph the group.

(*g*) A series of Geometridæ has been sent to Rev. George D. Hulst, Brooklyn, N. Y., for identification.

(*h*) All the material in the Hemipterous family Veliidæ has been borrowed by Mr. H. E. Summers for study.

(*i*) The undetermined Lepidoptera collected in Africa by Dr. W. L. Abbott have been sent to Dr. W. J. Holland, Pittsburg, Pa., for study.

(5) The work of arranging in permanent shape all the collections.

In the *Diptera*, mentioned in the last annual report as being for the most part arranged, the remaining families have been classified as far as they are studied in our fauna. In the *Lepidoptera* the North American Diurnals, Sphingid, Bombycid, and Geometrid families have been completely rearranged according to the last published classification, and the very large accessions incorporated. Of North American Diurnals 410 species are represented, and of Geometrids about 290 North American and 162 European species. A systematic arrangement has also been made of the tropical Diurnals, and they are represented as follows:

	Species.
From Mexico and Central America	169
From West Indies (outside of Trinidad)	10
From Trinidad (all of Acc. 25,335)	95
From South America	255
From Asia	42
From Australia	17
From Africa (outside of Abbott collection)	50

In the *Orthoptera* the North American collection has been rearranged, now occupying three full cabinets with sixty drawers, and containing

597 species in 5,925 specimens, besides numerous duplicates separately arranged. In the *Neuroptera* the North American species have been arranged in one cabinet with twenty drawers, and count 348 species (only 211 species named) in 1,185 specimens. In the *Coleoptera* the exotic species have been arranged in seventy-six single and double folding boxes.

The number of species represented in our collection of this order is as follows:

Coleoptera from—	Species.
Europe	3,200
Asia	236
Japan	63
Australia	312
New Zealand	310
Madagascar	28
Africa	450
South America	760
Hawaii	81
Central America	1,200
West Indies	100
United States and Canada	7,000
Total	13,740

In the *Hymenoptera* some of the families have been studied and the accessions incorporated.

(6) Mounting, expanding, and labeling specimens for the collection. Much time is taken up by this work, as a large percentage of the accessions arrive unmounted and all have to be labeled before distribution in the collections.

RESEARCHES.

Most of the special researches based upon museum material are mentioned under the paragraph relating to routine work. In addition to these, however, Mr. W. H. Ashmead has completed his monograph of the Proctotrypidæ of North America, based very largely on Museum material. This is the first monograph written upon the American representations of this group.

Dr. George Marx has had at his disposal the Acarians of the family Ixodidæ, belonging to the collection, and is engaged upon a monograph of the family.

PRESENT STATE OF THE COLLECTION.

During the last year about 16,000 specimens have been added to the collection. The last catalogue entry for June, 1891, is 746, and for June, 1892, is 1,041. The whole collection was carefully examined for museum pests during the month of June, and was found to be in a highly satisfactory condition.

REPORT ON THE DEPARTMENT OF MARINE INVERTEBRATES IN THE U. S. NATIONAL MUSEUM, 1892.

By RICHARD RATHBUN, *Honorary Curator.*

Much progress has been made during the past year in the study of the collections belonging to this department, especially of the higher crustaceans, and in the preparation of reports relating to them. As the west hall of the Smithsonian Institution has remained closed during this entire period, owing to delays in the completion of the repairs, it has not been possible to take any active steps toward the improvement of the exhibition series, although a very fair display has been maintained in the temporary quarters allotted for this purpose in the fish hall adjacent. There has been a marked increase over the previous year in the number as well as in the aggregate extent and value of the accessions which have been received from many diverse sources. Much time has necessarily been required in caring for these additions, and in attending to the continued preservation of the general collections, which have now attained so large a size as to severely tax the storage accommodations assigned to them. But few changes have been made in the quarters occupied by this department, and they remain therefore in essentially the same condition as described in the last report.

The curator has exercised only a general supervision over the affairs of the department, leaving to the assistant curator, Mr. James E. Benedict, and to Miss M. J. Rathbun, the burden of the work, which has been attended to, as heretofore, in the most thorough and conscientious manner.

The total number of accessions received was forty-six. The largest contribution was made by the U. S. Fish Commission and consisted mainly of crustaceans, chiefly brachyura and anomoura, represented by many species and a very large number of specimens, the same having been collected by the steamer *Albatross* in the North Pacific Ocean and Bering Sea; by the steamer *Fish Hawk* and the schooner *Grampus* on the Atlantic sea coast, and by Prof. B. W. Evermann in Texas. It also included a small collection of avian entozoa made by Prof. Edwin Linton in the Yellowstone National Park.

The other more important accessions were the following: From the Australian Museum, Sydney, New South Wales, 24 species of Australian echini, 14 of which were new to our collection, 13 species of Asteroidea and 50 species of brachyura and anomoura; the Rev. Canon A. M. Norman, of England, 22 species of European Paguridæ and Pycnogonidæ; Mr. George S. Brady, England, a named series of British fresh-water Cyclopidæ; Rev. H. Loomis, a large dried collection of crustaceans, echinoderms and sponges, from Japan; the Otago Museum, Dunedin, a collection of New Zealand crustaceans; Mr. John Murray, Edinburgh, Scotland, many specimens of hermit crabs, *Eupagurus*, from the Firth of Clyde; Mr. P. L. Jouy, a number of fresh-water crabs and crayfishes from Lake Chapala, Mexico, and crustaceans, echini, and worms from Guaymas; Dr. T. H. Morgan, of Bryn Mawr College, a collection of crustaceans from Jamaica; O. F. Cook and H. R. Jaquay, a series of Oniscidæ from different parts of the United States; the Kingston Exposition, Kingston, Jamaica, a large and very fine series of dried specimens of commercial sponges; J. C. Henderson, jr., and C. T. Simpson, a miscellaneous assortment of crustaceans from the west coast of Florida; Lieut. F. E. Sawyer, U. S. Navy, Brazilian crustaceans obtained during a trip in connection with the World's Columbian Exposition. The remaining contributions, while of smaller size than those enumerated, have also added many valuable specimens to the collection.

Two half-unit upright cases filled with large jars of especially interesting alcoholic specimens, such as crinoids, deep-sea pennatulæ, echinoderms, and crabs, have been added to the exhibition series in the fish hall, and Mr. Benedict has also experimented in the matter of making dried preparations of crustaceans for display purposes. This it is not generally difficult to accomplish with the brachyurans or true crabs, but the hermit crabs and shrimps are less amenable to such treatment, owing to their thinner shells and more delicate appendages. It is expected, however, that entirely satisfactory specimens can be prepared by careful treatment, and if the trials now being made turn out successfully it is proposed to increase the display collection. Another direction in which experimental work is being conducted by Mr. Benedict has reference to the manufacture of a plastic substance suitable for making reproductions of the softer animals and sufficiently durable for exhibition purposes. His efforts have already met with much success and promise important results not only for this, but also for several of the other departments of the Museum.

The customary routine work of the department, such as the maintenance of the collections, the periodical overhauling of all the specimens to insure their preservation by the renewal of alcohol or the removal of Museum pests, the assorting of recent additions, their cataloguing, labeling, etc., has been regularly attended to, and has occupied a very large amount of time. In the course of all systematic studies the specimens of each species regarded as duplicates have been separated at once from the reserve series, and the material for preparing new sets for distribution to educational institutions has therefore been gradually accumulating. Many such special sets have also been made up and disposed of as explained elsewhere. Much of the material in the line of marine invertebrates derived from the recent investigations of the Fish Commission has been assorted in this department, and several of the groups which are still unassigned for study have likewise been stored here. Progress has been made with the card or reference catalogue corresponding with the work in the identification of species, and so far as the collections are determined, it forms a convenient index to them. Collections of crustaceans borrowed from Union College and the Peabody Museum of Yale University for purposes of comparison have been returned to these institutions.

Some steps have been taken toward preparing an exhibition illustrating the scope of this department for the World's Columbian Exposition. These have consisted mainly in determining the family groups represented by the known American marine invertebrates and in ascertaining our desiderata in that respect. No more instructive exhibit for the use of biological students could be planned than one containing essentially all of these families, suitably displayed, and with accompanying descriptive labels.

The amount of cataloguing done during the year is explained in the following table:

Group.	Entries to June 30—		Entries made during year.
	1891.	1892.	
Crustaceans	15,814	16,987	1,173
Worms	4,935	4,958	23
Echinoderms and cœlenterates	17,640	17,759	119
Sponges and protozoans	6,315	6,318	3
Total			1,318

Mr. Benedict and Miss Rathbun have completed and published in the proceedings of the Museum a monograph upon the genus *Panopeus* of crabs, which is represented in the Museum collection by 25 species, of which 6 were previously undescribed. The hermit crabs belonging to the genus *Eupagurus*, of which 80 species are contained in our collection, have received much attention from Mr. Benedict, and a complete report upon the group is now in course of preparation. Explorations during the past few years, especially by the steamer *Albatross* in the North Pacific Ocean, have added 37 new species to this genus, and preliminary descriptions of these by Mr. Benedict have recently appeared in the Proceedings. He has also submitted for publication a paper upon the Corystoid crabs of the genera *Telmessus* and *Erimacrus*, illustrated with three plates, and has reported upon a collection of crustaceans obtained in the vicinity of Kingston, Jamaica, by Dr. T. H. Morgan. The latter report was printed in one of the Johns Hopkins University circulars, and the specimens have been deposited in the National Museum.

Catalogues of the Periceridæ and Maiidæ, families of maioid crabs, as represented in our collection, have been completed by Miss Rathbun, and she is at present at work upon the family Inachidæ. She has also prepared a list of the crustaceans obtained on the coast of Texas by Prof. B. W. Evermann, during a recent fishing investigation, for publication in the Bulletin of the Fish Commission. Large numbers of crustaceans belonging to other families than the above, principally the result of Fish Commission explorations, but some derived from other sources, have been identified and will be made the subject of report at a future time.

The department is indebted to Union College, Schenectady, N. Y., the Buffalo Society of Natural History, and Mr. F. A. Stearns, of Detroit, for the loan of specimens of crustaceans which were desired for examination and comparison in connection with the studies above referred to; and also to Mr. J. E. Ives, of the Philadelphia Academy of Natural Sciences, for assistance in comparing specimens sent from Washington with the collections of that society. Prof. S. I. Smith, of Yale University, has returned to this Museum for study, the maioid crabs, the Paguridæ and Porcellanidæ belonging to the earlier collections of the Fish Commission, and some Brazilian crustaceans collected by the curator. Mr. C. S. Dolley has also returned the crustaceans obtained by the steamer *Albatross* in the Bahama region, and sent to him for examination a few years ago.

Prof. A. E. Verrill and Miss K. J. Bush have continued their studies upon the Fish Commission collections, the property of the National Museum, now deposited under Prof. Verrill's charge at the Peabody Museum of Yale University. Prof. Walter Faxon, of the Museum of Comparative Zoölogy at Harvard College, has reported upon the crayfishes received in recent accessions, including a new species obtained in Mexico by Prof. A. Dugés; and the specimens of Oniscidæ have been sent for examination to Profs. O. F. Cook and H. R. Jaquay, of Syracuse University, Syracuse, N. Y., who are proposing to monograph that family. Prof. Edwin Linton, of Washington and Jefferson College, has described a number of bird entozoa collected by Mr. P. L. Jouy, at Guaymas, Mexico, and by himself at the Yellowstone National Park, and a paper upon the subject has been published.

Although no regular fishery investigations were undertaken by the U. S. Fish Commission steamer *Albatross* during the past year, yet incidental dredgings were made during a cruise to Bering Sea with the United States Seal Commissioners, in the summer of 1891, and during the hydrographic survey for a cable route between California and the Hawaiian Islands the following winter. Many interesting and several new forms of deep-sea invertebrates were obtained in the course of both of these expeditions, and shore collecting was also carried on at Honolulu. The investigations of the steamer *Fish Hawk* and the schooner *Grampus* on the Atlantic coast have been limited to the shallow and surface waters, and while the natural history collections obtained by them are not extensive, they will eventually add some material of importance to this department.

Ten sets of duplicate marine invertebrates, belonging to series No. IV, the composition of which has been described in previous reports, have been distributed to educational institutions, as follows: Biological School, Avon-by-the-sea, N. J.; Wells College, Aurora, N. Y.; Trinity University, Durham, N. C.; Fort Worth University, Fort Worth, Tex.; State Normal School, Mankato, Minn.; Iowa State Normal School, Cedar Falls, Iowa; State Normal School, Whitewater, Wis.; Mansfield Memorial Museum, Mansfield, Ohio; Leland Stanford Junior University, Menlo Park, Cal.; Pennsylvania State Normal School, Millersville, Pa.

The following special collections have also been supplied, namely: To the Australian Museum, Sydney, New South Wales, 73 species of echinoderms; to the University of Toronto, Toronto, Canada, 73 species of echinoderms and cœlenterates; to Tulane University, New Orleans, La., 13 species of corals, 27 species of echinoderms, and 23 species of crustaceans; to the Royal Zoölogical Museum, Copenhagen, Denmark, a large series of radiates and crustaceans; to the National Deaf-Mute College, Kendall Green, Washington, D. C., 37 species of corals, echinoderms, hydroids, and sponges. A number of other institutions and of individuals have likewise been furnished with a few species each, generally for purposes of special study or to supply deficiencies in their collections.

REPORT ON THE DEPARTMENT OF COMPARATIVE ANATOMY IN THE U. S. NATIONAL MUSEUM, 1892.

By FREDERIC A. LUCAS, *Assistant Curator.*

The general work of the year has been, as heretofore, mainly in the preparation and arrangement of osteological material, but much has been accomplished for the department of vertebrate fossils, the work of that department being, so far as the Museum is concerned, carried on by the Department of Comparative Anatomy.

The most important accession of the year was the skeleton of a young sperm whale, obtained through the courtesy of the Life-Saving Service, from the station at Green Run Inlet, Capt. J. J. Dunton, keeper. Many fishes have been received from the U. S. Fish Commission in connection with their work for the World's Columbian Exposition, among them a fine tarpon and a specimen of the opah, *Lampris luna*, the latter having a special value as being the first example taken near our coast. From the Fish Commission also came an adult bastard loggerhead turtle, *Colpochelys kempi*, one of the special desiderata in this department. A second skeleton of the rare fork-tailed gull, *Creagrus furcatus*, together with other desirable skeletons of birds, was procured by Mr. C. H. Townsend, of the Fish Commission steamer *Albatross*.

In addition to the regular routine work a new catalogue of vertebrate fossils has been commenced, and the greater part of the material in that department has been recatalogued, a task that has entailed much comparison of specimens with published figures, reference to other catalogues, and some necessary identifications.

This has taken a great deal of the time of the assistant curator, as, owing to the smallness of the force, nearly all the work, even to its simplest details, has devolved upon him. Twenty lots of recent and fossil bones have been reported on, and work has been continued on the synoptic exhibition series of invertebrates, both in the preparation of specimens and of labels. Comparatively few additions have been made to the exhibition series, as the work of the preparators has been mainly devoted to material for the study series, and these additions have been chiefly skeletons of fishes, that class being at present rather poorly represented. It may be said, however, that a number of specimens were prepared for mounting, which, owing to the pressure of other work, could not be finished. A small number of Auzoux models, illustrating certain details of digestion and circulation, have been purchased for the exhibition series, as well as some for use in connection with the series of invertebrates.

The details of the work of the preparators are given in the report of the osteological preparator,* and it speaks well for the skill and industry of the assistants that so much has been accomplished in spite of the many unavoidable interruptions.

The ever-increasing care of the collections has prevented any special researches, although the assistant curator has devoted a little time to the study of the osteology of the *Steganopodes*, a group of birds unusually well represented in the Museum. Dr. R. W. Shufeldt, to whom material has been loaned, has continued his work on the osteology of North American birds. Material has been furnished to Prof. Cope, for his work on North American reptiles, and to the Bering Sea Commission in connection with their inquiries concerning the fur seal.

PRESENT CONDITION OF THE COLLECTION.

The present state of the collection is good, but if time admitted and space were available, a great deal of work might be most profitably done in labeling and arranging the study series.

The exhibition series is in good shape, but some changes are needed in a few of the purchased specimens, and some of the labels should be replaced by others more descriptive in their character.

The number of specimens on exhibition at the end of the year was as follows:

Skeletons of—	
Mammals	196
Birds	71
Reptiles	39
Batrachians	7
Elasmobranchs and fishes	35
Skulls of mammals	63
Other osteological pieces	58
Auzoux anatomical models	25
Total	494

The number of osteological specimens on exhibition has been lessened since the report of 1891 by the transfer of some pieces to the Department of Vertebrate Fossils and the temporary withdrawal of a few others.

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* See p. 65.

The additions to the collection as shown by entries in the catalogues are as follows:

	Last number, June 30—		Increase.
	1891.	1892.	
Mammals	35144	35526	382
Birds	19002	19105	103
Reptiles	29300.	29325	25
Fishes	26085	26149	64
Total	....	....	574

REPORT ON THE DEPARTMENT OF FOSSIL PLANTS IN THE U. S. NATIONAL MUSEUM, 1892.

By LESTER F. WARD, *Honorary Curator.*

The work of the year has been in general a continuation of that outlined in the report for last year, the object in mind being the arrangement of the specimens in such a manner as to facilitate their consultation and study. The work of rearranging and labeling the Carboniferous specimens was continued to some extent, but the Museum assistant, Mr. Theo. Holm, has spent the larger part of his time in caring for the herbarium. Many specimens have been mounted and added to the collection, and it has in other ways been made of greater assistance in the study of fossil plants.

During the year there have been added to the collection more extensive and valuable accessions than ever before in the history of the department of fossil plants. The first of these is the immense collection of Potomac plants turned over by the U. S. Geological Survey through Prof. William M. Fontaine, of the University of Virginia. This collection, filling thirty-one large boxes, and representing several thousand specimens, embraces the entire series of types and duplicates used by Prof. Fontaine in the preparation of his elaborate Potomac or Younger Mesozoic Flora, which forms Volume XV of the Monographs of the U. S. Geological Survey. This flora is a very remarkable and interesting one. It embraces about 365 species, of which number 75 are dicotyledons of peculiar and archaic types, representing perhaps the oldest dicotyledonous flora known in the world.

At the same time the U. S. Geological Survey, through Prof. Fontaine, turned over the specimens representing the older Mesozoic flora, which had been used by Prof. Fontaine in the preparation of Monograph VI, entitled "Contributions to the Knowledge of the Older Mesozoic Flora of Virginia." This collection was contained in nine boxes, and represented several hundred specimens. It is an exceedingly valuable collection, not only because it contains most of the types described in the above work, but because it embraces many particularly fine if not unique specimens.

No gift of greater importance to the department of fossil plants has ever been made than that by Mr. R. D. Lacoe, of Pittston, Pa., under the terms of which his great collection of fossil plants is to be permanently deposited in the National Museum. The value of this collection, one of world-wide reputation, is far greater than that of the entire amount of the collections in the department prior to the date of its gift. The task of procuring fossil plants from the older formations for use in paleontological and biological research has been prosecuted for nearly twenty years by its donor, whose liberal means and scientific and practical mining knowledge, as well as his favorable location in the heart of the northern anthracite coal field, have enabled him to bring together an invaluable body of material, of which Prof. Lesquereux remarked in one of his last publications:* "Mr. R. D. Lacoe, of Pittston, has procured from almost all the localities where coal is worked in the United States an immense amount of specimens, far beyond any seen, even in the largest museums of Europe." Since the above quotation was written Mr. Lacoe has continued his work, having several collectors in his employ in various States and the Acadian provinces, a portion of the material collected having been examined by Prof. Lesquereux. Besides gathering this material in the field, he has also purchased a number of private collections containing many type specimens, so that it is perhaps safe to say that nearly one-half of the types of the American Carboniferous flora now lie within the Lacoe collection. In fact, there are few outstanding American types except those resting in several State geological museums. But even the deficiency in the balance of originals has largely been compensated for by the collection of duplicates from the type localities, and these, like all other collections made prior to 1889, were examined and labeled by the original author of nine-tenths of the Paleozoic species described from the United States, Leo Lesquereux. How prominent a part this material has taken in both the biological and economic applications may be recognized at a glance in the three volumes (especially the third) of the "Coal Flora," published with an atlas by the second geological survey of Pennsylvania in 1878–1884, Report P. It is sufficient to add in this place that within this collection the data for working out the geological and geographical distribution of the Carboniferous plant species, as far as they can be worked out at the present stage of exploration, is probably more ample than that of all other American collections combined.

It will at once be seen that the accession of this invaluable wealth of material will necessarily make this institution, as the repository of the types or authentic specimens of nearly all the American Paleozoic species, the reference center for all extensive work on the Paleozoic flora in this country in future, as well as the custodian of valuable geological correlation data. But the proper installation in this Museum of so great a collection, numbering about 100,000 specimens, is a matter involving much embarrassment in the way of space and study facilities, it being agreed in the terms of the gift that this collection, to be kept entire and known as the "Lacoe Collection," shall, together with all future additions, either by exchange or gift of the donor, be kept in order and made accessible to scientists and students without distinction, under such proper rules and restrictions as may be necessary for the preservation from loss or injury of the specimens.

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*Ann. Rep. 2d Geol. Surv. Penna., 1886, Pt. 1, p. 493.

As constituted at present the collection consists of: (1) Types and study specimens; (2) Fine exhibition slabs and specimens; (3) Boxes containing (a) unstudied and (b) duplicate material. The area required by the first class, making no allowance either for the future accessions or for new material to be found in the boxes not yet examined, amounts to over 1,000 drawers of the size in ordinary use in the Museum. The exhibition material will occupy about 2,100 square feet. Of the balance of the collection, about 80 boxes, a portion only will require drawer space, while the remainder may be labeled and made in some way accessible as exchange material.

Arrangements were made whereby, in January and February of this year, Mr. David White, assistant paleontologist in the U. S. Geological Survey, spent four weeks in Pittston engaged in work preliminary to the transfer of the collection. Among the boxes brought back was a small portion of the type and study exhibition material. Two cases of exhibition material have been arranged and labeled by Mr. White, and they now stand in the central rotunda.

The remainder of the cases brought from Pittston include a large quantity of material more or less thoroughly studied by Prof. Lesquereux and supposed to represent species either new to science or not before found in this country.. Most of these unpublished specimens examined by Prof. Lesquereux are accompanied by MS. in various stages of completion, or notes with some illustrations. All this new matter, together with the plants in question, has been placed by Mr. Lacoe in the hands of Mr. White, who will assist him in revising, verifying, and completing the posthumous work for publication. Much time and labor will be necessary in the preparation of the MS. and additional drawings for the publication, which should appear as soon as possible, before this portion of the collection is ready for enrollment on the Museum register. Owing largely to failing health during the last years of Prof. Lesquereux's scientific labors a considerable time will need to be spent in going through the collection in a scrutinous review. This task, along with the identification of a large quantity of new material, probably requiring five or six months, it is the donor's desire to have accomplished. before the entire collection is removed and enrolled on the Museum books. It can probably be best done in Pittston, where Mr. Lacoe will be at hand to furnish any needed geographical or stratigraphical information.

In the removal of so enormous a collection it will perhaps be better to transfer it by orders or groups as fast as the necessary scrutiny and completion of labels and enrollment are finished. It is therefore desirable that, whenever the work is renewed, cases may be ready for its reception as fast as the material arrives in Washington.

The separation of the duplicate specimens for exchange will be simultaneous with the review and registry of the specimens. These should be labeled and fully listed before placing them in an accessible storage. Several exchanges have already been engaged with American and European paleontologists, the specimens for which may be selected while the collection is being packed.

In acquiring the Lacoe collection the Museum not only receives a most important paleontological accession, but it becomes the custodian of a large mass of unelaborated correlative material, which, if rightly used, will prove of great value and aid to scientific and economic geology; and this rich possession affords just ground for national scientific pride, while the liberal public spirit with which it was given is worthy of imitation by all patrons of science.

My investigations of the local exposures of the Potomac formation, as mentioned in my last report, were continued as opportunity afforded throughout the year. In September and October I made, in company with several members of the U. S. Geological Survey, an extended field trip to Texas and Arkansas with a view of determining the probable relation of the Trinity formation of those States with the Potomac formation. In April I also made another field trip, this time studying the Lower Cretaceous formations of Alabama, securing a valuable collection of fossil plants. Later, in May and June, I made an extensive overland journey from the Potomac to the Raritan in New Jersey for the purpose of studying the relation of the Potomac of Virginia and Maryland and the so-called "Amboy clays" of New Jersey. The results were in every way sasisfactory and will be published by the U. S. Geological Survey.

Mr. Theo. Holm was the Museum assistant for the entire year. His time was mainly spent in work on the herbarium, with a view to making it of the greatest possible value in the study of fossil plants. He mounted and placed in the cases several hundred sheets of plants, largely native trees and shrubs, and at the close of the year was engaged upon the duplicate collection in selecting such as it seemed desirable to mount for the study series. He had also begun the determination of a collection of plants from Morocco, obtained during 1889 by Mr. Talcott Williams, of Philadelphia.

Prof. F. H. Knowlton continued during the year his study of the Laramie flora, and had well under way at the close a revision of the plants of this group, based on the original Lesquereux type specimens in the National Museum and large recent collections from Colorado. When this work is completed, it is hoped that the Laramie flora will be placed on a basis that will admit of its extensive geological use. Prof. Knowlton also identified and revised, by the aid of Museum material, a considerable collection of plants from the Bozeman (Montana) coal field and prepared a report which will soon be printed. It enumerates forty-four species, five of which are described as new to science.

The accessions of Upper Paleozoic material, with the exception of the fossil woods, have been examined by Mr. David White, who has reported on all minor transmittals. In connection with his regular survey work Mr. White has also spent a considerable time on the collections sent by Dr. J. H. Britts from the lower coal measures of Missouri, and the first collection forwarded by L. Graff from Van Buren, Ark., the specimens being studied by genera, together with those of the Carboniferous plant collections of the U. S. Geological Survey now in his hands. The work on the Britts collections, which include a number of new or little known forms, will probably be completed by the 1st of January. His study and other work on the Lacoe collection is mentioned in the part of this report relating to that particular collection.

Mr. Charles S. Prosser was in the field from July 1 to August 26, engaged in studying the Middle and Upper Devonian formations of Monroe, Pike, and Wayne Counties, Pa., with special reference to the flora and fauna. The collection made is of great importance in determining doubtful horizons and correcting previous errors. His time in the office was largely spent on the compendium of paleobotany which has been in preparation for some years in this office.

An entirely new arrangement of the exhibition series of fossil plants was begun. Heretofore the plants had been arranged systematically, with a view to illustrating, as far as the material admitted, the origin and development of plant life, but it had been found that plants widely separated geologically were brought side by side, and it was thought best to abolish the botanical and substitute for it the geological arrangement. Each plan of arrangement has its advantages, but as all the other paleontological collections were arranged geologically it seemed as well to have the plants conform. The system of placing each specimen on an ebonized block was also abandoned as unsatisfactory.

As the exhibition series is confined to a single row of table cases in the fossil court, nothing like a complete series can be shown, but beginning with the lowest plant-bearing rocks, enough specimens were placed on exhibition to give a fairly good idea of the predominant vegetation of each period. The specimens illustrating the Devonian, a part of the Carboniferous, and all of the Potomac were put in the cases. The last-named flora, that of the Potomac, is very fully exhibited on account of its peculiar types of vegetation. The other formations will be as fully illustrated as the space will admit.

The flora of the Dakota Group, by the late Prof. Leo Lesquereux, as announced in the last annual report, was printed during the year.

It forms Monograph XVII of the U. S. Geological Survey. The larger part of the type specimens upon which it is based is now the property of the Museum. Of these not now here, many are in the lately donated collection of Mr. R. D. Lacoe and will be brought here shortly. A few of the types are in the Museum of the University of Kansas, but by the kindness of the chancellor, Prof. F. H. Snow, duplicates, in some cases better than the originals, have been donated, so that the Museum now has probably the most complete collection extant representing this flora.

Prof. William M. Fontaine, of the University of Virginia, has worked up a small but very interesting collection of plants from the Kootanie beds at Great Falls, Mont. Several species and varieties are found to be new, and the whole collection has been described and discussed in an illustrated paper which is about to be published in the "Proceedings of the National Museum."

Several exceptionally fine specimens of a gigantic fossil alga (*Nematophyton crassum*), obtained by Mr. Charles S. Prosser, at Skunnemunk Mountain, near Monroe, Orange County, N. Y., have been made the basis of a special study by Prof. D. P. Penhallow, of McGill University, Montreal, Canada. His paper, illustrated by a number of photomicrographs, is also about to be published in the "Proceedings of the National Museum."

In Lesquereux's Tertiary Flora (p. 70, Pl. LXIII, Figs. 1, 1*d*) there was described and figured a peculiar silicified fossil plant from near Golden, Colo., under the name of *Zamiostrobus mirabilis*. This specimen, No. 100 of the catalogue of fossil plants in the National Museum, was, by request, loaned to H. Graf zu Solms-Laubach, professor of botany in the University of Strasburg, Germany, who was making a special study of all the fossil cycadean stems and fruits of the world. He had several large thin sections cut from the specimen and gave it a thorough microscopical study, which resulted in his changing the name to *Cycadeoidea pamiostrobus*. The specimen has been returned with several microscopical preparations.

In addition to the Lacoe collection, about 25,000 specimens have been added to the collection of the department during the year, making a total increase of about 125,000 specimens.

The last catalogue entry for June, 1891, is 3,503, and for June, 1892, is 3,598, an increase of 95 entries.

REPORT ON THE DEPARTMENT OF PALEOZOIC INVERTEBRATE FOSSILS IN THE U. S. NATIONAL MUSEUM, 1892.

By C. D. WALCOTT, *Honorary Curator.*

The year's work, in its bearings upon the collections, has been very much the same as for 1890–'91, when I reported that it was indirect rather than direct, owing to the necessity for my completing certain work for the U. S. Geological Survey. Large quantities of material have been received from the collectors of the Survey, much of which has been placed in storage awaiting an opportunity to have it elaborated and transferred to the Museum. During the month of July, 1891, the collection of Cambrian and Ordovician fossils, belonging to the exhibition series, was completed and placed on exhibition and a large number of labels written for it. And at various times during the year additions of individual specimens were made to the exhibition series.

In the laboratory considerable time was given to painting the record numbers on the specimens belonging to the accessions of previous years that had not been fully recorded, and in the preparation for study of a large amount of material obtained by the collectors of the Geological Survey. Owing to the crowded condition of the laboratory and the want of exhibition space, more attention was given to the preparation of material for future study and exhibition than to the immediate incorporating of it into the exhibition series.

Mr. Oscar Hinrichs, jr., was employed during the year in his various duties connected with the laboratory and the exhibition series—entering, numbering, and labeling the accessions, writing cards for the exhibition specimens, etc.

During the week of the meeting of the International Congress of Geologists (in August) many of the leading paleontologists and geologists of Europe visited and examined the collections of fossils in the Museum. They commented most favorably on the Museum exhibition and also on the large amount of fine material in the various laboratories.

Reference to the papers published by me during the year is made in the Bibliography (Section IV).

During the year 29 accessions were received. A list of them is here given.

LIST OF ACCESSIONS FOR THE FISCAL YEAR 1891-'92.

	Specimens.
Acc. 23938. From E. A. Hauske, Bellevue, Iowa, one Crinoid and one small shell, found in Pennsylvania. (Returned to registrar. Of little value without exact locality)	2
Acc. 24356. From A. W. Barker, Orlando, Fla. (Returned to registrar, to be referred to Dr. W. H. Dall.)	
Acc. 24597. From Australian Museum, Sydney, Australia. (Not examined.)	
Acc. 24609. From Sv. Leonh. Tornquist, Lund, Sweden. (Not examined.)	
Acc. 24610. From D. H. Chapin, Baltimore, Md.:	
Hamilton group:	
Phacops rana	1
Acc. 24641. From Herbert E. Brock, Mason City, Iowa:	
Devonian:	
Spirifera (?)	6
cyrtiniformis	2
orestes	2
whitneyi Hall	2
hungerfordi Hall	2
Cyathophyllum sp	3
Atrypa reticularis Linnaeus	3
aspera Schlotheim	2
Streptorhynchus chemungensis	2
Orthis iowensis Hall	2
Cryptonella calvini	3
Strophodonta demissa Conrad	2
exilis	3
arcuata, Hall	2
Bellerophon (?) sp (?)	2
Productus dissimilis Walcott	2
Strophodonta reversa Hall	3
Naticopsis gigantea Hall and Whitf.	2
	45
Acc. 24652. From Charles Yale, Louisiana, Mo. One Orthoceras (purchased)	1
Acc. 24837. From Geo. R. Bryan, (bequest of O. N. Bryan), Marshall Hall, Charles Co., Md. 39 species. 105 specimens.	
Acc. 24855. From Joseph A. Young, Bellevue, Iowa. Pentremites sp	4
Acc. 24935. From Willie B. Tate, 1459 Florida avenue, N. W., Washington, D. C. Brachiopod (Paleozoic)	1
Acc. 25058. From Elmer Rambo, Lower Providence, Pa. Pentremites sp	12
Acc. 25061. From Edward S. Golson, South Saginaw, Mich. Several species of Silurian corals from drift	15
Acc. 25155. From Walter D. Wilcox, 127 College street, New Haven, Conn.:	
Middle Cambrian:	
Acrotreta gemma var. depressa Walcott	3
Agnostus interstrictus White	2
Algæ (?)	1
Acrothele subsidua White	2
Hyolithes sp	2
Hyolithellus sp	7
Graptolite	2

Acc. 25155. From Walter D. Wilcox, etc.—Continued.

Middle Cambrian—Continued.

Hypostoma sp	3
Kutorgina, like K. sterlingensis	2
Lingulella macconnelli	3
Orthisina alberta	1
Sponge	2
Scenella sp	3
Ogygopsis klotzi (?)	23
Ptychoparia cordilleræ	7
sp	2
Bathyuriscus howelli Walcott	5
Olenoides nevadensis Walcott	12
Zachanthoides spinosus	6
	88

Acc. 25288. From Henry G. Bryant, 1227 North Broad street, Philadelphia, Pa.:

Middle Cambrian:

Paradoxides bennetti	1

Acc. 25325. From Dr. Karl Rominger, Ann Arbor, Mich.:

Middle Cambrian:

Ogygopsis klotzi Rominger	130
Bathyuriscus howelli Walcott	13
Olenoides nevadensis Meek	5
	148

Acc. 25496. From Benjamin Vail, 344 E street NE., Washington, D. C.:

Calymene senaria	1

Acc. 25500. From Williamsburg Scientific Society, through Louis Kirsch, president, Brooklyn, N. Y. Rock specimen containing specimens of brachiopods.

Acc. 25502. From F. A. Randall, Warren, Pa.

Acc. 25508. From Herbert E. Brock, Mason City, Iowa:

Physetocrinus ventricosus	1
Dichocrinus inornatus	1
Strotocrinus ægilops	1
Dorycrinus parvus	2
Eretmocrinus verneuilanus	1
Strotocrinus regalis	1
Agaricocrinus tuberosus	2
Batocrinus æqui brachiatus	3
	12

Acc. 25514. From Dr. J. H. Lemon, New Albany, Ind. Fossil shells, mostly duplicates of the Museum collection	400
Acc. 25523. From L. C. Lane, Frankfort, Ky. Fossil shells	
Acc. 25590. From Williamsburgh Scientific Society, through Louis Kirsch, president, Brooklyn, N. Y. Brachiopod	1
Acc. 25607. From Mrs. L. M. Tucker, Ortonville, Mich. Corals (from drift)	14
Acc. 25617. From Frank Russell, Iowa City, Iowa. Pentamerus decussatus Whiteaves	8
Acc. 25630. From Geo. U. S. Hovey, White Church, Kans. Productus symetricus. (Returned.)	1

Acc. 25655. From Frank Russell, Iowa City, Iowa:

Corals	41
Protozoa sp	6
	47

Acc. 25670. From New York State Museum, through Prof. J. M. Clarke.
Acc. 25683. From Herbert E. Brock, Mason City, Iowa.
Acc. 25711. From Chas. Miller, jr., Grand Rapids, Mich.

The catalogue numbers taken up were from 24059 to 24153, both inclusive; but many additional numbers will be used when the unfinished accessions have been prepared for record.

REPORT ON THE DEPARTMENT OF MESOZOIC INVERTEBRATE FOSSILS IN THE U. S. NATIONAL MUSEUM, 1892.

By C. A. WHITE, *Honorary Curator.*

During the past year, as in preceding years, the work of this division has been done wholly by members of the U. S. Geological Survey; and yet the usual routine, and much of the special work pertaining to it, has been fully attended to.

The fossil collections have continued to increase during the year, the most important accession having been received from the U. S. Geological Survey. This accession (No. 25725) embraces 10,566 specimens and includes some of the most important paleontological material which has been studied by members of the Survey. A large part of this accession is now placed in the exhibition series, and more of it will be similarly placed as soon as time for the work can be spared.

The entries in the Museum catalogue for the year range from 21752 to 22170.

REPORT ON THE DEPARTMENT OF BOTANY IN THE U. S. NATIONAL MUSEUM, 1892.

By Dr. GEORGE VASEY, *Honorary Curator.*

The report now presented constitutes my fourth annual report relating to the National Herbarium.

The growth of the herbarium has been steady, although the per cent. of increase has not equaled that of last year. The herbarium has practically been rearranged during the past year. New genus-covers and genus-labels have been substituted for the old ones. The labels are printed either in black or red. The black label implies that the genus belongs to North America north of Mexico; the red label implies that the genus is foreign. These are divided into two groups: Mexican and South American, and Old World. Each is placed in a separate genus-cover. The native and foreign genera are not otherwise separated. The species under each genus, as a rule, are arranged alphabetically; in some American genera of which there are recent monographs, the species are arranged systematically, with an alphabetic index to the species. The Phanerogams have been arranged according to Durand's Index.

The Ferns are arranged by genera according to Hooker's Species Filicum. In the case of the Mosses, Liverworts, and Lichens the genera are arranged alphabetically.

The Fungi are represented by 16,397 specimens and contain 6,424 species. They are now kept in the Division of Vegetable Pathology, Department of Agriculture.

The Mosses and Liverworts have all been remounted during the past two years. These are kept in tight pockets. Six of these pockets belonging to one species are glued upon a single sheet of the standard size of mounting paper and filed away, as ordinary herbarium specimens. The number of pockets of Mosses in the herbarium at the pressent time is 8,154, and of Liverworts 1,300.

The mounted specimens are almost free from all kinds of herbarium pests. Our duplicate collections, however, were threatened with destruction by what the entomologist of the Department of Agriculture considered a new genus of insects, probably introduced with specimens sent from the dry regions of western Mexico. The pest is a small geometrid larva about 8^{mm} long. In order to get rid of this larva, a wooden box with close-fitting top was prepared, of the following dimensions: 4 feet long by 20 inches wide and 2 feet deep. This box was then filled with bundles of plants, a cup holding about half a gill of bisulphide of carbon was placed with them, covered, and allowed to remain for twenty-four hours or more. This operation was repeated until all the duplicates had been poisoned. Our large collections are treated in this manner when they first arrive.

During the year a card catalogue of all the botanical works in the libraries to which this department has access, has been begun. Already the library of the Department of Agriculture has been catalogued, and many of the books in the Library of Congress and the library of the Smithsonian Institution.

ACCESSIONS.

The accessions received during the year ending June 30, 1892, number 512 (catalogue Nos. 991 to 1503), of which 41 were received through the National Museum (as shown in the tabulated statement accompanying this report); the rest, mostly from collectors employed by the Department of Agriculture. The following are some of the more important accessions:

Two sets of Pringle's Mexican collection, of 287 species each, one obtained by donation and one by purchase.

About 50 specimens from Dr. Charles Mohr, mostly ballast plants collected about Mobile, Alabama.

A set of 47 Californian species, from J. G. Lemmon, obtained by donation.

A set of 60 species from C. V. Piper, of Washington, obtained by exchange.

A set of 33 specimens of eastern United States plants obtained by donation from William M. Canby.

A set of 107 specimens obtained by exchange from G. McCarthy.

A collection of 2,150 specimens made by Frederick V. Coville on the Death Valley Expedition.

A set of 285 species obtained by purchase from A. A. Heller.

A set of 450 species of New Zealand plants, sent by J. F. Cheeseman.

A set of 125 species of African plants obtained by donation from J. M. Wood, Natal, Africa.

A collection of 776 Californian species from S. B. Parish, obtained by exchange.

A set of 470 South American plants obtained by purchase from Thomas Morong.

A set of 1,340 specimens from C. Copineau, of Paris, obtained by exchange.

A set of 297 species from the Malay peninsula obtained by purchase from C. Curtis.

A set of 1,709 specimens, collected by G. C. Nealley in Texas and Arizona.

A set of 2,530 specimens from United States and Europe, obtained by exchange and purchase from J. M. Holzinger.

A set of 250 plants, collected by Dr. E. A. Mearns, U. S. A., in Minnesota and Texas.

A set of 3,521 specimens from Mexico and Arizona, collected by Dr. Edward Palmer.

A set of 733 plants collected in the Indian Territory by C. S. Sheldon.

A set of 615 specimens collected by F. F. Wood in Minnesota and Canada.

A set of 106 plants collected by S. M. Tracy in Mississippi.

A set of 1,793 specimens collected in Nebraska by P. A. Rydberg.

A set of Canadian plants numbering 233, collected by J. M. Macoun.

A set of 425 specimens collected by T. E. Wilcox in Arizona.

A set of 28 plants collected by E. P. Sheldon in Minnesota.

A set of 1,411 specimens from Arizona, collected by D. T. McDougal.

A set of 15,191 plants collected by J. H. Sandberg and assistants in Minnesota and Idaho.

A set of 2,011 specimens collected in Florida by J. H. Simpson.

A set of 1,590 specimens collected by M. A. Carleton in Kansas, Oklahoma, and New Mexico.

A set of 93 specimens from E. L. Greene, collected in California, Washington, and Alaska.

A set of 144 specimens collected by G. A. Holzinger in North Dakota.

A set of 140 plants (United States and foreign) collected by H. A. Green.

The total number of specimens received from all sources is 53,384.

The number of specimens mounted and distributed into the collections is about 12,000.

The number of packages sent out from the herbarium is 335. The number of herbarium specimens sent to college museums, experimental stations, etc., is 15,748.

The number of plants remaining in the duplicate collection is about 75,000.

The following table will show a comparison of the work with the two previous years:

Comparative statistics of the herbarium for the years 1890, 1891, 1892.

	1890.	1891.	1892.
Specimens received	21,346	40,963	53,384
Sent to experimental stations, etc	7,951	8,456	15,748
Number of accessions	370	621	512

The following list indicates the accessions to this department which were received directly by the National Museum:

Catalogue No.	Accession No.	Date.	Name of sender.	Number of species.
1003	1250	July 7	F. G. Arthur	1
1024	24555	July 14	Mrs. C. M. Ferry	1
1038	24614	July 21	C. G. Pringle	287
1049	1286	July 24	Hoare and Felt	1
1050	1294	...do	J. A. Field	1
1051	1298	...do	F. E. Knowles	9
1073	1307	Aug. 1	Mrs. L. T. Eggleston	1
1076	1315	Aug. 3	Mrs. H. M. Case	1
1077	24673	...do	Ernest Walker	2
1112	1352	Aug. 24	C. B. Bryan	1
1134	24727	Aug. 31	A. Dugès	14
1172	24044	Sept. 25	Mrs. J. A. Sherman	404
1214	1468	Oct. 16	M. O. Bear	1
1230	24957	Oct. 28	Aukland Museum	450
1248	1507	Nov. 6	A. G. Sanders	3

Catalogue No.	Accession No.	Date.	Name of sender.	Number of species.
1261	1519	Nov. 13	F. E. Knowles	5
1262	25035	...do....	J. A. Chambers	1
1281	25084	Nov. 28	U. S. Fish Commission	6
1282	25079	...do....	......do	139
1283	25080	...do....	......do	84
1285	1547	Dec. 3	J. Brockway	1
1300	1567	Dec. 29	D. O. Stovall	1
1319	25267	Jan. 11	R. R. Gurley	19
1342	25288	Feb. 8	H. G. Bryant	2
1346	1607	Feb. 15	W. P. Barratt	1
1351	1610	Feb. 20	G. B. Lartigue	1
1352	1611	Feb. 23	W. T. Lander	1
1354	25404	Feb. 24	Miss M. J. Rathbun	87
1355	1547	Feb. 25	W. J. Brockway	1
1386	1633	Mar. 19	G. S. Thomson	19
1391	25436	Mar. 31	O. Tollin	5
1399	25510	Apr. 6	Dr. A. Nehring	1
1400	1653	Apr. 7	R. Forrester	1
1403	1664	Apr. 13	C. B. Bash	3
1415	25601	Apr. 23	Department of State	2
1429	25578	May 4	E. A. Mearns	36
1449	25709	May 18	J. Huntley	1
1475	1725	June 3	A. D. Foy	4
1479	1733	June 8	B. S. Davis	1
1480	1732	...do....	J. A. Lyons	1
1481	1737	...do....	H. Mac Rae	1

REPORT OF THE DEPARTMENT OF MINERALS IN THE U. S. NATIONAL MUSEUM, 1892.

By F. W. CLARKE, *Honorary Curator.*

Probably no year has been more productive of good results in the department of minerals than the one now ended. A large part of the systematic exhibition series has been remounted on ebonized blocks, replacing the former white paper trays; and soon the entire series will be so displayed. Several cases of this series have been supplied with printed specimen labels, and the work of labeling is still in progress.

A large double case has been substituted for the small single gem-case, so that now the collection of gems and semi-precious stones, numbering 2,215 specimens, is contained in two large double mahogany cases. Of this collection 1,717 specimens are on exhibition.

Many specimens belonging to the reserve and duplicate series had accumulated in drawers stacked up in the mineral laboratory. The reserve specimens have been transferred to the cases in the exhibition hall, and the duplicates have been disposed of by restocking the cases containing the classified duplicates, and by packing and sending the remainder to storage; of these last there were 7,823 specimens. The systematic duplicate series has been thoroughly overhauled and reclassified, and it has been much improved by rejecting inferior specimens and adding new and better material. This series is now used largely for improving the collection by means of exchanges with other museums and private collectors. During the year exchanges of 371 specimens of minerals have been made with 13 different parties and 61 specimens have been sent out as gifts, making a total disbursement of 432 specimens.

Considerable time has been consumed in selecting and preparing the mineral and gem series to be exhibited at the World's Columbian Exposition in Chicago. The scheme for this exhibit is subjoined:

1. A series of crystallized minerals to illustrate the crystal form of minerals. (*a*) Crystals not attached; (*b*) distinctive crystals on matrix; (*c*) crystal groups.
2. A series illustrative of the twinning of crystals.
3. A series to illustrate the irregularities of crystals.
4. A series of crystalline aggregates.

5. A series of mineral pseudomorphs.
6. A series to illustrate cleavage and fracture.
7. A series to illustrate diaphaneity, color and lustre.
8. A series of gems and ornamental stones.

ACCESSIONS.

Among the most important accessions, mention may be made of the following:

Twenty-five boxes of minerals from Pennsylvania, the gift of Joseph Willcox, of Philadelphia. (Acc. 24802.)

A suite of 11 specimens of minerals from Branchville, Conn.; 1 specimen from Salisbury, Conn., and 1 specimen from Brewsters, N. Y., the gift of Prof. S. L. Penfield, of Yale University. (Acc. 25202.)

Four specimens of ornamental stones and 1 specimen of churchite, the gift of Mr. Clarence S. Bement, of Philadelphia. (Acc. 25395.)

A crystal of spangolite from Tombstone, Ariz., the gift of Prof. S. L. Penfield, of Yale University. (Acc. 25421.)

Two cut specimens of transparent spessartite from Amelia C. H., Va., the gift of Mr. Ira R. Allen, of Fair Haven, Vt. (Acc. 25739.)

Three specimens of native gold from the Potomac Mine, Montgomery Co., Md., deposited by Mr. A. B. Russ, of Washington, D. C. (Acc. 24805.)

Twenty-nine specimens of ornamental stones from various localities, purchased of Mr. W. J. Knowlton, of Boston, for the World's Columbian Exposition. (Acc. 24545.)

Thirty-two specimens of minerals from various localities, nine of them for the World's Columbian Exposition, purchased of H. A. Ward, of Rochester. (Acc. 24778 and 24779.)

Eleven gems from Maine and New Hampshire, bought of Mr. T. F. Lamb, of Portland, for the World's Columbian Exposition. (Acc. 24927.)

Nineteen specimens of minerals from various localities purchased of Messrs. English & Co., New York City, for the World's Columbian Exposition. (Acc. 24849.)

In addition to the foregoing, several lots of minerals have been received from the U. S. Geological Survey.

The condition of the collection, with the exception of the study series, which is only partly classified, is very satisfactory. The systematic exhibition series of minerals is displayed in twenty-two mahogany and plate-glass double slope-top cases, arranged in rows in the exhibition hall. The series is arranged mainly according to Dana's system, and each specimen is mounted on an ebonized wooden block, 1½ inches thick, on the beveled front of which is fastened a gray cardboard label, clearly printed, giving the name of the species, its variety, the locality of the specimen, the name of its donor or collector, and its catalogue number.

When the installation has been completed, the series will be provided with species labels, indicating the chemical composition of each species, its crystallographic form, hardness, specific gravity, its varieties with their characteristics, and any additional information which may be of public interest.

The ornamental stone collection is displayed in single specimens and in groups, on black and white plush pads, each specimen or group having a card-board label beneath it.

The meteorite collection consists at present of an exhibition series only, no attempt having yet been made to separate from it a study or a duplicate series, though many exchanges have been made by which the collection has been largely built up. It is installed in mahogany wall-cases with plate-glass fronts, each specimen occupying a black tray with a beveled front, the bottom of which is lined with dark red billiard cloth. The labels are of French gray card-board, like those of the systematic mineral series, and give similar information, the date of the fall or find being added when known.

PRESENT CONDITION OF THE COLLECTION.

The condition of the collection at present is as follows:

Specimens in the recent accession case	64
Specimens in the systematic series	3,395
Specimens in the Lea collection of micas	384
Specimens in the case of duplicates	57
Specimens in the meteorite collection	187
Specimens in the Shepard collection of meteorites	447
Casts of meteorites	9
Pedestal specimens	10
Specimens in the wall-case series	195
Specimens in the collection of gems and semi-precious stones	1,717
Photographs	13
Total	6,469

IN THE STUDY SERIES.

Specimens in the systematic series	12,575
Specimens in the Lea collection of micas	1,052
Specimens of gems and ornamental stones	498
Total	14,125

IN THE DUPLICATE SERIES.

Specimens in the systematic series	8,153
Specimens in storage	7,823
Casts of meteorites	3
Total	15,979
Total number of specimens in the collection	36,375

During the year 1,454 entries on the catalogue have been made, representing 4,121 specimens. Of these, 3,350 were assigned to the reserve series, 763 to the duplicate series, and 8 were rejected. Nineteen were specimens reëntered by mistake and 30 were specimens belonging to the old collection. The last catalogue entry, June 30, 1891, was 50188; June 30, 1892, 51642.

REPORT ON THE DEPARTMENT OF GEOLOGY IN THE U. S. NATIONAL MUSEUM, 1892.

By GEORGE P. MERRILL, *Curator.*

As during the previous year, a considerable proportion of our time has been occupied in the arrangement of the exhibition series. This work was interrupted during the months of November, December, and January by the laying of the new pavements in the south-west court and west-south range. This necessitated moving all the floor-cases in both halls, and, incidentally, nearly every specimen, since specimens and labels were as a rule displaced by the jar caused by moving the cases, or else were so covered with dust as to necessitate thorough cleansing. Aside from the mere delay here involved, fully two months were actually lost, so far as advance of work was concerned, in restoring the collections to their original conditions.

A very important work of the year has been the preparation of some two hundred sets of duplicates for gratuitous distribution. In addition to the immense quantity of duplicate matter received from the Centennial Exposition at Philadelphia in 1876, there has since accumulated much other valuable material, and the long-deferred time seemed to have actually arrived when the department could begin to respond to its many applications. In order, however, that the collections might be to some extent systematic, several collecting trips were undertaken during the late summer and fall. Mr. W. H. Newhall was thus engaged in New Jersey and Virginia in August and September, and the curator made brief trips into New Jersey, Maine, and Massachusetts on similar errands. The collections thus obtained are noted under the head of accessions. The following list shows the character of the material put into these series:

List of duplicate rocks and ores distributed by the Smithsonian Institution on behalf of the National Museum.

[NOTE.—These collections have been made systematic as far as the duplicate material was available for the purpose. The specimens included in this set are indicated by a check mark (√). With each specimen is wrapped a label, giving its name and that of the locality in which it was obtained.]

No. of specimen.	Name.	Locality.
1	Gold ore. Auriferous sulphurets	Gilpin County, Colo.
2	Gold ore. Auriferous sulpharsenides in quartz	Kern County, Cal.
3	Gold ore. Auriferous sulphurets in quartz	Mariposa County, Cal.
4	Gold-silver ore. Quartz with auriferous and argentiferous sulphurets.	Comstock Lode, Storey County, Nev.
5	Gold-silver ore. Siliceous rock with auriferous and argentiferous sulphurets.	French District, Owyhee County, Idaho.
6	Silver ore. Ruby silver and stephanite in quartz.	Reese River District, Lander County, Nev.
7	Silver ore. Granitic rock carrying silver chloride.	Colorado.
8	Silver ore. Hard carbonate ore	Leadville, Lake County, Colo.
9	Silver-lead ore. Argentiferous galena	Utah.
10	......do	Hidden Treasure Mine, Utah.
11	......do	Montana.
12	Silver-copper ore. Argentiferous chalcopyrite	Pocahontas Mine, Fremont County, Colo.
13	Lead-zinc ore. Galena and sphalerite	Portugal.
14	Lead-zinc ore. Galena, blende and mispickel in quartz.	Dona Ana County, N. Mex.
15	Lead-zinc-copper ore. Galena, sphalerite, and chalcopyrite.	Do.
16	Zinc ore. Calamine	Friedensville, Pa.
17	Zinc ore. Sphalerite	Do.
18	Zinc ore. Smithsonite	Austria (?).
19	Zinc ore. Willemite, zincite, and franklinite	Franklin Furnace, Sussex County, N. J.
20	Copper ore. Chalcopyrite	Queensland, Australia.
21	......do	Dona Ana County, N. Mex.
22	......do	Ely, Orange County, Vt.
23	Copper ore. Native copper in feldsitic conglomerate.	Calumet and Hecla Mine, Lake Superior, Michigan.
24	Copper ore. Native copper in melaphyr	Lake Superior, Michigan.
25	Nickel ore. Nickeliferous pyrrhotite	Gap Mine, Lancaster County, Pa.
26	Nickel-copper ore. Nickeliferous pyrrhotite and chalcopyrite.	Modum, Norway.
27	Nickel ore, Oxidized ore. (Erythrite, Anabergite, etc.)	Lovelocks, Churchill County, Nev.
28	Silver-lead ore. Cerussite	Utah and Nevada.
29	Tin ore. Cassiterite with wolfram and pyrolusite.	Temescal, San Bernardino County, Cal.
30	Pyrite. For making sulphuric acid	Rio Tinto, Portugal.
31	......do	Louisa County, Va.
32	Pyrite and chalcopyrite. For making sulphuric acid.	Do.
33	Iron ore. Red hematite	Giles County, Va.
34	Iron ore. Magnetite	Essex County, N. Y.
35	............do	Sweden.
36	Iron ore. Hematite, specular iron ore	Marquette County, Mich.
37	Iron ore. Siderite	Germany.
38	Iron ore. Limonite	Do.
39	......do	Lawrence County, Ind.
40	Iron ore. Hematite. Called fossil ore	Tennessee.

List of duplicate rocks and ores distributed by the Smithsonian Institution on behalf of the National Museum—Continued.

No. of specimen.	Name.	Locality.
41	Manganese ore. Impure wad	Tennessee.
42	Manganese ore	Do.
43	Ferro-manganese	Italy.
44	......do	Austria.
45	Native sulphur	Rabbit Hole Mine, Humboldt County, Nev.
46	Mercury ore. Cinnabar	California.
47	Chromite. Chrome iron ore	Shasta County, Cal.
48	Anthracite coal. Graphitic	Newport, R. I.
49	......do	Schuylkill County, Pa.
50	Bituminous coal	West Virginia.
51	Cannel coal	Kentucky.
52	Graphite	Buckingham, Quebec, Canada.
53	Emery rock	Chester, Hampden County, Mass.
54	Phosphatic sandstone	South Carolina.
55	Massive apatite	Canada.
56	......do	Norway.
57	Rock salt	Petite Anse, La.
58	Kaolin	Lawrence County, Ind.
59	Biotite granite	Woodstock, Md.
60	......do.	Red Beach, near Calais, Me.
61	......do	
62	Biotite muscovite granite	West Concord, N. H.
63	Orbicular granite	Craftsbury, Vt.
64	Hornblende syenite (drift)	Cape Elizabeth, Me.
65	Elæolite syenite	Litchfield, Me.
66	......do	Libertyville, N. J.
67	Diabase	York, Pa.
68	......do	
69	Olivine diabase	Mine La Motte, Mo.
70	Gabbro	
71	Diorite	
72	Norite	Keeseville, N. Y.
73	Kersantite	Franklin Furnace, Sussex County, N. J.
74	Camptonite	Lewiston, Me.
75	Quartz porphyry	Ironton, Mo.
76	Liparite (rhyolite)	Yellowstone National Park.
77	......do	Zacatecas, Mexico.
78	Liparite (obsidian)	Yellowstone National Park.
79	......do	Mono Craters, Cal.
80	Trachyite	Silver Cliff, Colo.
81	Phonolite	Black Hills, Dak.
82	Hornblende andesite	Yellowstone National Park.
83	Hornblende andesite	Madison County, Mont.
84	Basalt	Yellowstone National Park.
85	......do	
86	Melaphyr	Brighton, Mass.
87	Peridotite (picrite)	Little Deer Isle, Me.
88	Peridotite (hornblende picrite)	Stoney Point, N. Y.
89	Peridotite (dunite)	Cullasaja, N. C.
90	Pyroxinite	Webster, N. C.
91	Theralite	Crazy Mountain, Mont.
92	Impure serpentine	Chester County, Pa.
93	Serpentine	Deer Isle, Me.
94	Serpentine	Montville, N. J.

List of duplicate rocks and ores distributed by the Smithsonian Institution on behalf of the National Museum—Continued.

No. of specimen.	Name.	Locality.
95	Serpentine	Easton, Pa.
96	Serpentine (variety Williamsite)	Fulton, Lancaster County, Pa.
97	Glaucophane rock	Sonoma County, Cal.
98	Gneiss with cordierite	Guilford County, Conn.
99	Gneiss	Montgomery County, Md.
100	Amphibolite	Hanover, N. H.
101	Mica schist	West Washington, D. C.
102	Quartzite	Potsdam, N. Y.
103	Steatite (soapstone)	Grafton, Vt.
104	Crystalline limestone (marble)	West Rutland, Vt.
105	Crystalline dolomite (marble)	Westchester, N. Y.
106	......do	Lee, Mass.
107	Ophiolite	Essex County, N. Y.
108	Limestone (fossiliferous)	Rochester, N. Y.
109	Limestone (oölitic)	Indiana.
110	......do	Kentucky.
111	Limestone (coral)	Bermuda.
112	Slate	Buckingham, Quebec, Canada.
113	Gypsum	Saltville, Va.
114	Calc Sinter	Yellowstone National Park.
115	Siliceous oölite	Center County, Pa.
116	Chert	Licking County, Ohio.
117	Sandstone (Triassic)	Seneca Creek, Md.
118	Sandstone (Subcarboniferous)	Berea, Ohio.
119	Calcareous conglomerate	Loudoun County, Va.
120	Rhyolite tuff	Douglas County, Colo.
121	......do	Zacatecas, Mexico.
122	Infusorial earth	Pope's Creek, Md.
123	......do	Nevada.
124	Oölitic sand	Salt Lake, Utah.
125	Shell sand	Hawaiian Islands.
126	Lapilli	Mono Craters, Cal.

Unfortunately it was impossible to make the sets all alike either in kind or number. The following list shows the full number included in each set as boxed ready for shipment:

Numbers.	Specimens, each.	Numbers.	Specimens, each.
1 to 48	104	124	82
49 61	103	125	81
62 67	102	126 to 128	80
68	101	129 131	79
69 71	99	132 140	78
72 85	98	141 145	77
86 91	96	146 150	76
92	94	151 165	77
93 94	93	166 171	76
95 98	92	172 174	75
99 105	91	175 183	74
106 109	90	184 187	73
110 113	89	188	72
114	88	189 191	71
115 116	87	192 193	70
117	86	194	68
118 119	85	195	67
120 122	84	196 200	66
123	83		

The work of preparing an exhibit for the World's Columbian Exposition was entered upon late in September. It was decided that the department should, so far as the limited appropriations permitted, make an exhibit illustrative of the various phenomena grouped under the heads of I, Vulcanology; II, Glaciers and Glaciation, and III, Caves and Cave Deposits.

The general character of the exhibit, as planned, may be understood by reference to the outline given below:

I. *Vulcanology.*

(1) Map showing distribution of active volcanoes.
(2) Map showing areas of volcanic rocks in the United States.
(3) Photographs and other illustrations of active and extinct volcanoes.
(4) Diagrams and models showing shape of volcanic cones and lava flows, crater lakes, hot springs and geysers, natural scenery as modified by volcanic action.
(5) Specimens showing volcanic products; (*a*) Characteristic forms, as columnar, slaggy, pumiceous and glassy lavas, bombs, lapilli, sand, and dust. (*b*) Kinds of lavas, both ancient and modern. (*c*) Kinds ejected by same volcano at different periods of activity.
(6) Contact phenomena and secondary minerals.
(7) Economy of volcanoes and allied phenomena (Hot Springs, etc.), as shown by chemical products, pozzuolana, building-stone, travertines, "onyx" marbles, etc.
(8) Destructive effects as shown at Pompeii, etc.

II. *Glaciers and Glaciation.*

(1) Views illustrating living glaciers, icebergs, etc.
(2) Relief map of the United States, showing the ice sheet of the glacial epoch in its lobate stage.
(3) Illustrations of glacial phenomena, as fields covered by drift bowlders; large stranded bowlders illustrating direction of drift and transporting power of ice sheet; kames, drumlins, etc.
(4) Specimens showing grooving, striation, and polishing; drift clays, sands, gravels, and bowlders; scratched bowlders from till.
(5) Economy of glaciers: View of glaciated landscapes, showing how denudation has rendered accessible deeply buried materials; leda clays and their utilization; drift bowlders for building material.
(6) Destructive effects: Fields covered by bowlders; forests destroyed. [Shown by illustrations only.]

III. *Caves and Cave Deposits.*

(1) Theoretical sketch showing method of formation by solvent action of water.
(2) Actual plans and sections of caves.
(3) Cave interiors. Shown by photographs and transparencies.
(4) Cave deposits (stalactites, stalagmites, etc.). Shown by specimens. These in part cut and polished to show color and structural variations.
(5) The economy of caves. Shown by blocks and slabs of cave marble (stalagmite); nitrous earths and other salts.
(6) Cave life. Shown by bats, eyeless fish, crayfish, insects, etc.
(7) Caves as dwellings.

The work of obtaining materials illustrative of glacial action in the eastern United States was placed in the hands of Prof. W. O. Crosby. As the work is still in progress at time of writing, nothing more need now be said regarding it.

For the purpose of collecting materials for this exhibit the curator left Washington October 27 for Arizona and New Mexico, returning December 16. A large amount of volcanic and cave material was collected during this time, which will be noted under the head of accessions. May 17 the curator again left on a similar errand, visiting caves in Virginia, Tennessee, Kentucky, Indiana and Missouri. The material obtained during this trip was exceptionally good, as well as varied in character, but owing to the fact that his absence was prolonged beyond the end of the fiscal year, it cannot here be reported on in detail.

NOTES UPON THE MORE IMPORTANT ACCESSIONS RECEIVED DURING THE YEAR.

One hundred and sixteen regular and 135 temporary accessions were received during the year, the regular accessions comprising upwards of 4,000 specimens. The more important of these are mentioned below. It should be stated that a large share of these materials are designed for the duplicate series or for the World's Columbian Exposition.

Gold and silver ores from Marquette County, Mich. Gift of J. Ropes. 24521.

Fossiliferous marble from Tennessee. Gift of T. S. Godfrey. 24522.

Rocks and ores from the quicksilver district of Almaden, Spain. Collected by G. F. Becker.

Silver ore, Colorado. Gift of A. Sadtler. 24546.

Rock salt, Livingston County, N. Y. Gift of Retsof Mining Company. 24554.

Crude petroleum, Santa Clara, Cuba. Gift of C. W. Cunningham, U. S. Geological Survey. 24580.

Gneiss with cordierite, Guilford, Conn. Collected by O. C. Farrington. 24581, 24639.

Volcanic rocks, Lower California. Received from Dr. Ed. Palmer. 24600.

Manganese ore, Tennessee. Gift of H. Claiborne. 24605.

Kaolin, Bloomfield, Fla. Gift of Alex. Lynch. 24604.

Ores and minerals from Utah and Scotland. Gift of R. Forrester, Schofield, Utah. 24611.

Crude nitrate of soda, Iquique, Chili. Gift of C. H. White. 24619.

Silver ore, San Bernardino County, Cal. Gift of W. H. Gould. 24638.

Iron ore, Llano County, Tex. Gift of R. T. Hill. 24642.

Thirty-four specimens phosphate rock, Florida. Gift of E. Willis. 24640.

Twenty-four specimens phosphate rock, Florida. Gift of Florida Phosphate Company. 24676.

Zinc ore and barite, Virginia. Collected by G. P. Merrill. 24734.

Feldspar, New York, Maine, and Delaware. Gift of Golding and Sons. 24720.

Silver ore, El Paso, Tex. Gift of W. H. Von Streeruwitz. 24725.

Stalagmite marble, Washington County, Va. Collected by G. P. Merrill. 24729.

Copper ores, Huntington, Oregon. Gift of Phillip A. Markson. 24735.

Asbestus, Knights Ferry, Cal. Gift of James H. Lowe. 24723.

Magnetic iron ore, Green County, Ga. Gift of John C. Hart. 24741.

Granite, with native copper, Butte, Mont. Gift of C. H. Hand. 24797.

Two hundred specimens gypsum, Saltville, Va. Gift of W. B. Robertson. 24820.

Photograph of sandstone dike, Chadron, Nebr. Gift of Prof. Robert Hay. 24881.

Feldspar, South Glastonbury, Conn. Gift of Charles H. Hall. 24895.

Elæolite syenite, Beemerville, N. J. Collected by W. H. Newhall. 24903.

Zinc ores, Franklin, N. J. Collected by W. H. Newhall. 24912.

Forty-seven specimens ores, England. Received from R. N. Worth. 24794.

Five hundred specimens calcareous breccia, Loudoun County, Va. Collected by W. H. Newhall. 25002.

Eleven specimens silver ores, New South Wales. Gift of Walter J. Koehler. 24503.

Contorted rock, Sugar Loaf Mountain, Maryland. Received from George H. Williams. 25057.

Copper ore, Washington County, Idaho. Gift of C. F. Drake. 25081.

One hundred specimens melaphyr, Brighton, Mass. Received from George H. Barton. 25101.

Two hundred specimens siliceous oölite, State College, Center County, Pa. Received from George R. Wieland. 25106.

Twenty-three specimens ores and rocks, El Paso County, Tex. Gift of W. A. von Streeruwitz. 25059.

Silver ore, Sonora, Mex. Gift of John Alexander. 25189.

Zinc ore and barite, Union County, Tenn. Gift of Philip A. Markson. 25147.

Thirteen specimens eruptive rocks, etc., Chatham Island, Galapagos. Received from U. S. Fish Commission steamer *Albatross*. 25157.

Silver ores, Mexico. Gift of W. J. McGee. 25195.

One hundred and sixty-one specimens rocks and ores from Arizona and New Mexico. Collected by G. P. Merrill. 25198.

(In part) a fine specimen of native silver from the Black Hawk district, near Silver City, N. Mex. Gift of E. M. Hand. 25198.

Onyx, Yavapai County, Ariz. Collected by G. P. Merrill. 25199.

Augite rocks, New Haven, Conn. Received from S. Ward Loper. 25200.

Rocks, Texas. Gift of W. H. von Streeruwitz. 25206.

Contorted slate, Rutland County, Vt. Received from U. S. Geological Survey. 25207.

Yellow ochre, Monroe County, Ala. Gift of Claiborne Ochre Company. 25208.

Kaolin, Langley, S. C. Gift of T. S. Lamar & Co. 25211.

Rock salt, Kanopolis, Kans. Gift of Royal Salt Company, James Cowie, superintendent. 25213.

Silver ore, Charcas, Mexico. Collected by P. L. Jouy. 25212.

Tin ore and pig tin, Temescal Mine, San Bernardino County, Cal. Gift of Hon. W. W. Bowers. 25183.

Fifteen specimens rocks, Massachusetts. Received from William North Rice. 25210.

A large series of volcanic materials, Arizona and New Mexico. Collected by G. P. Merrill. (25226), 25231.

Fifty-seven specimens ores and rocks, Arkansas. Received from W. P. Jenney. 25253.

Two hundred and ninety-three specimens ores and rocks, Texas, Oregon, New Mexico, Cedros Island, Nevada, California, and Colorado. Collected by F. W. Crosby. 24310.

Thirty-seven specimens ores and minerals, various localities. Received from E. E. Howell. 25277.

Zinc ores, Jasper County, Miss. Collected by W. P. Jenney. 25276.

Forty-six specimens ores, etc., England. Received from R. N. Worth. 25233.

Wurtzillite, Emery County, Utah. Gift of Robert Forrester. 25324.

Volcanic rocks, Peru and Mexico. Gift of Otto P. Pfordte. 25278.

Red sandstone, Pecos City, Tex. Gift of Pecos Red Sandstone Co. 25351.

Elæolite syenite, from New Hampshire, and gold ore and coal from Maine. Gift of W. S. Bayley. 25366.

Ores and rocks, Labrador and Newfoundland. Gift of Henry G. Bryant. 25288.

Ores and rocks, New Mexico. Collected by G. P. Merrill. 25384.

Hornblende schist with free gold, Pennington County, S. Dak. Gift of H. John Ainley. 25396.

Shale with rain prints, Durham, Conn. Gift of S. Ward Loper. 25428.

Granite (4-inch cube), South Brookville, Me. Gift of A. F. Eells. 25430.

Ore and rocks, Texas. Gift of W. H. von Streernwitz. 25482.

Silver and zinc ores, Aspen, Col. Gift of S. L. Penfield. 25261.

Silver ore, British Columbia and Loess Formation, China. Gift of R. Hitchcock. 25499.

A large series of stalactites and stalagmites, Luray, Va. Collected for World's Fair exhibit by James H. Morrison. 25517.

Clays and molding sand, Devonshire, England. Received from R. N. Worth. 25527.

Banded argillite, Canyon, Col. Gift of S. Ward Loper. 25546.

Quartz, Topsham, Me. Gift of Wilson Manufacturing Company. 25585.

Salt, Lake "El Sal del Rey," Texas. Gift of John G. Bourke. 25619.

Rocks, New Mexico. Received from W. Lindgren. 25622.

Magnetite containing native gold, Carroll County, Md. Gift of J. W. Tyson. 25648.

Rocks, District of Columbia. Gift of J. W. Langdale. 25673.

Iron ore, Marquette, Mich. Gift of G. J. Northrup. 25802.

Iron ore, Siqua iron mines, Santiago de Cuba. Gift of John Vallance, superintendent. 25803.

CHARACTER OF ROUTINE WORK.

The character of the routine work has varied but little from that of preceding years. The work of preparing the duplicate series necessitated the overhauling and breaking up of many of the large ore piles that have hitherto cumbered the west front; 36 boxes were also withdrawn from storage, and their contents utilized. In process of this work some 15,057 specimens of rocks and ores were broken up, trimmed, labeled and wrapped ready for packing. The final work of packing these 200 sets, though scarcely completed at the end of the fiscal year, was so nearly done as to be properly comprehended in this report.

A large amount of time was devoted to the installation of the economic series in the southwest court and which may now for the first time claim to be in a condition approximately satisfactory.

Duplicates have been sent out, mainly in the way of exchanges, as follows:

July 9, 1891, to James Allen, 3 specimens of rocks.

July 25, 1891, to A. T. Odeneal, 1 specimen of rock.

August 31, 1891, to M. Mali, Belgian consul, 17 specimens of coal.

September 3, 1891, to R. N. Worth, 152 specimens of ores.

September 7, 1891, to C. E. Vawter, 3 boxes (150 pounds).

September 9, 1891, to George H. Barton, 5 boxes (1,235 pounds).

September 9, 1891, to E. E. Howell, 183 specimens of rocks.

September 15, 1891, to E. E. Howell, 300 pounds of ores and 3 specimens of slab marbles.

October 9, 1891, to E. E. Howell, 59 specimens of ores.
October 15, 1891, to R. Forrester, 6 specimens of minerals.
December 22, 1891, to H. S. Williams, 24 specimens of rocks.
December 30, 1891, to George R. Wieland, 57 specimens of rocks.
December 30, 1891, to V. F. Marsters, 51 specimens of rocks.
February 3, 1892, to W. O. Crosby, 598 specimens of ores.
March 9, 1892, to U. S. Commissioner of Patents, 34 specimens of petroleum.
March 21, 1892, to H. S. Williams, 48 specimens of rocks.
April 2, 1892, to Arizona Onyx Company, 7 specimens of onyx slabs.
April 4, 1892, to H. T. A. Lemon, 35 specimens of ore fragments.
April 4, 1892, to Prof. Bigelow, 100 pounds of ore fragments.
April 9, 1892, to E. E. Howell, 2,600 pounds of rocks and ores.
April 20, 1892, to Maine State College, 115 specimens of ores.
April 27, 1892, to S. Ward Loper, 1 specimen of onyx.
May 17, 1892, to E. E. Howell, 6 specimens of rocks and ores.

Total, 4,385 pounds and 1,398 specimens of rocks, etc.

This list does not include the 200 boxes comprising 17,924 specimens above referred to.

The work of identifying materials sent in by those not connected with the Museum continues, as heretofore, to consume its full share of time. The following list of special reports will serve to give some idea of the extent of this practice. As stated previously, the department can not make assays or analyses on such occasions, but whenever possible without too great an outlay of time, the mineralogical nature of the material has been ascertained and the applicant referred elsewhere for information not obtainable here. These reports were made as follows:

Pyrite. Sent by Cover Orndorff, Mount Olive, Florida. 1248.
Material for assay. Sent by J. Goldsmith, Carlisle, N. Mex. 1251.
Material for assay. From James Palmer, Grantsville, Utah. 1257.
Material for assay. From Michael Keenan, Springer, N. Mex. 1265.
Material for determination. Sent by Frank Cook, Huston, Idaho. 1272.
Material for determination. Sent by J. H. Pisor, Horr, Mont. 1276.
Iron ore. Sent by L. K. Yeatts, Elva, Va. 1283.
Rocks for determination. Sent by Mrs. M. L. Narrin, Goodrich, Mich. 1288.
Fire clays. Sent by Miss L. A. B. Cornuck, Genito, Va. 1287.
Pyrite. Sent by H. Warren & Son, Oregon, Lincoln County, Tenn. 1292.
Clay. Sent by F. G. King, 60 Park avenue, Rochester, N. Y. 1297.
Material for assay. Sent by Geo. W. Bullene, Seattle, Wash. 1301.
Supposed tin ore. Sent by Emil Wilvert, Sunbury, Pa. 1310.
Phosphates. Sent by C. D. Galvin, New York City. 1324.
Material for assay. Sent by Jones Taylor, of San Bernardino, Cal. 1325.
Rocks for determination. Sent by William Nelson, of Columbia, Va. 1339.
Quartz. Sent by J. B. Copeland, of Harrisburg, Pa. 1341.
Material for assay. Sent by M. A. Geiger, Silver, Wash. 1343.
Pyrite. Sent by Abram Brown, Rohrerstown, Pa. 1345.
Material for assay. Sent by C. D. Galvin, New York. 1351.
Clays. Sent by S. E. Wilkes, Charlie Hope, Va. 1354.
Iron ore and bituminous shales. Sent by John Somers, Cle-Elum, Wash. 1360.
Ocherous clay. Sent by J. C. Chesney, Northumberland, Pa. 1361.
Ancient marbles. Sent for identification by Hermann Jaske, Dayton, Ohio. 1368.
Manganese and iron ores. Sent by B. S. Belcher, Ada, W. Va. 1369.

Material for assay. Sent by M. V. Harris, Cherry Creek, Miss. 1371.

Material for assay. Sent by W. B. Gibbs, Jackson, W. Va. 1380.

Material for assay. Sent by Cassady Linthicum, Hyattsville, Md. 1376.

Material for assay. Sent by E. H. Stewart, Little Rock Creek, North Carolina. 1383.

Material for determination. Sent by Geo. H. Babcock, Phillipsburg, Mont. 1386.

Supposed aluminum ore. Sent by W. A. C. Bryan, Nephi City, Utah. 1389.

Pyrite. Sent by Levi Frye, Rinkerton, Va. 1390.

Volcanic glass. Sent by A. F. Canter, Jordan Valley, Oregon. 1391.

Material for determination. Sent by R. F. Eller, Kenterville, Idaho. 1401.

Ore. Sent by W. G. Mercier, Washington. 1403.

Rocks for examination. Sent by Prof. W. O. Crosby, Boston, Mass. 1408.

Material for assay. Sent by M. J. Bailey, Chester, N. Dak. 1410.

Rock. Sent by J. H. Chase, Wenatchee, Wash. 1419.

Materials for determination. Sent by Frank Burk, Nephi City, Utah. 1422.

Materials for determination. Sent by B. S. Belcher, Ada, W. Va. 1423.

Limonite and slag. Sent by F. H. Moyers, Clapp's Ford, Tenn. 1426.

Pyrrhotite. Sent by John Long, Sand Point Station, Idaho. 1432.

Material for identification. Sent by Ed. Hassatt, Atoka, Choctaw Nation, Ind. T. 1433.

Material for determination. Sent by N. D. Holmes, Toledo, Ark. 1435.

Supposed tin ore. Sent by W. E. Stevens, Wenatchee, Wash. 1436.

Material for determination. Sent by J. E. Luce, Cisco, Tex. 1452.

Material for determination. Sent by J. B. Rosenborough, Aransas Pass, Tex. 1453.

Material for assay. Returned to sender. 1456.

Limonite. Sent by Stanley M. Crites, Pipestone, Mich. 1458.

Copper ore for determination. Sent by Alex. Clark, Port Angeles, Wash. 1461.

Supposed silver ore. Sent by Mrs. A. M. Finney, St. James Hotel, Washington, D. C. 1462.

Material for determination. Sent by J. O. Flack, Atoka, Ind. T. 1463.

Material for determination. Sent by Miss Sarah Hollingsworth, Dogwood P. O., Douglas County, Mo. 1472.

Material for assay. Sent by J. W. Wentworth, Payson, Ariz. 1475.

Micaceous hematite. Sent by J. W. Craig, Muchet, Augusta County, Va. 1476.

Quartz and feldspar. Sent by A. W. Shaffer, Raleigh, N. C. 1479.

Material for determination. Sent by E. A. Hanske, Bellevue, Iowa. 1498.

Material for assay. Sent by W. E. Stevens, Wenatchee, Wash. 1509.

Pyrite and pyrrhotite. Sent by H. C. Wallace, Alta City, Utah. 1510.

Galena. Sent by A. Block, Bowling Green, Ky. 1516.

Quartz. Sent by George W. Malone, Hornbeak, Tenn. 1532.

Clay. Sent by E. E. Vail, St. Augustine, Fla. 1533.

Supposed lead ore. Sent by J. V. Surprenant, Anaconda, Mont. 1537.

Clay. Sent by B. Stinson, Paoli, Ind. 1540.

Siliceous sand. Sent by W. P. Hobson, Pueblo, Colo. 1541.

Pyrite. Sent by John G. Steele, Rock Hill, S. C. 1538.

Material for assay. Sent by A. C. Trump, Lake Valley, N. Mex. 1551.

Material for assay. Sent by D. S. Heron, Globe, Ariz. 1553.

Pyrite. Sent by Milo Winters, Crown Point Center, N. Y. 1556.

Material for determination. Sent by A. Devereaux, Decatur, Tex. 1559.

Material for assay. Sent by Charles Faulk, East Liverpool, Ohio. 1560.

Material for assay. Sent by S. O. Remington, Phillipsburg, Mont. 1563.

Material for determination. Sent by Richard Bennett, Eureka Springs, Ark. 1564.

Material for assay. Sent by A. H. Bracken, Hensley, Yancey County, N. C. 1565.

Material for determination. Sent by Geo. H. Vickers, Lame Deer, Custer County, ont. 1568.

Quartz porphyry. Sent by Dr. Scott Hill, Augusta, Me. 1569.

Minerals for determination. Sent by Sarah Hollingsworth, Dogwood P. O., Mo. 1570.

Biotite granite. Sent by A. F. Eells, Boston, Mass. 1571.

Material for determination. Sent by Chas. A. Raber, South Riverside, Cal. 1573.

Material for determination. Sent by P. P. Player, Bledsoe, Ala. 1574.

Pyrite. Sent by S. Heymann, Fayetteville, Tenn. 1576.

Material for determination. Sent by C. W. McAlarney, Plymouth, Pa. 1578.

Pyrrhotite. Sent by Leonard D. Siver, Spokane, Wash. 1579.

Bituminous limestone. Sent by Benson Lewis, Thurber, Piute County, Utah. 1580.

Magnetite, supposed tin ore. Sent by S. I. Gaskill, Salesville, Gallatin County, Mont. 1586.

Phosphatic limestone. Sent by C. G. Faucher, Flagstaff, Ariz. 1592.

Material for assay. Sent by J. Stouffer, Wooddale, Pa. 1593.

Supposed ore for determination. Sent by J. S. Lee, Roswell, N. Mex. 1595.

Micaceous schist carrying graphite. Sent by J. A. Navarre, Chelan, Wash. 1596.

Material for assay. Sent by Wm. McVay, Prineville, Oregon. 1598.

Material for identification. Sent by J. Stouffer, Wooddale, Pa. 1599.

Material for determination. Sent by Hunt Bros., Sturgis, Miss. 1601.

Supposed ore, for determination. Sent by Geo. Kenney, Elf, Clay County, N. C. 1604.

Clay, for analysis. Sent by R. F. Thorne, Iuka, Tishomingo County, Miss. 1606.

Sand for determination. Sent by Robert Goudie, Nashville, S. Dak. 1609.

Minerals for determination. Sent by R. T. Ford, Naillon, Tenn. 1612.

Minerals for analysis. Sent by Geo. Bonnell, Tooele City, Utah. 1615.

Ore for determination. Sent by W. L. Detrick, Julian, San Diego County, Cal. 1616.

Clay for analysis. Sent by A. D. Merick, The Portland, Washington, D. C. 1618.

Supposed ore. Sent by C. H. Campfield, Dulzura, San Diego County, Cal. 1620.

Material for determination. Sent by B. S. Belcher, Ada, Mercer County, W. Va. 1622.

Material for determination. Sent by C. H. Campfield, Dulzura, San Diego County, Cal. 1625.

Material for assay. Sent by George H. Buchanan, Tannersville, N. Y. 1631.

Material for assay. Sent by H. E. Stufflebeam, Delaney, Ark. 1636.

Clay, supposed aluminum ore. Sent by R. E. Cook, Nottingham, Ala. 1637.

Pitchstone. Sent by Paul Murn, Boulder, Mont. 1638.

Metal for determination. Sent by J. Stouffer, Wooddale, Fayette County, Pa. 1639.

Material for assay. Sent by J. Ebaugh, Carrollton, Carroll County, Md. 1640.

Alloy for determination. Sent by J. R. Hunt, jr., Sturgis, Miss. 1641.

Supposed gold ore. Sent by Gen. P. N. Hagner, Washington, D. C. 1642.

Stalagmitic limestone. Sent by C. E. Van Deren, Cottonwood, Ariz. 1645.

Material for assay. Sent by G. W. Chambers, Egger, Ark. 1647.

Volcanic dust. Sent by Levi Allen, Salubria, Idaho. 1648.

Eruptive rock. Sent by Dr. W. S. Newlon, Oswego, Kans. 1649.

Material for assay. Sent by H. A. James, Oklahoma. 1652.

Clay. Sent by T. S. Harris, New York, N. Y. 1655.

Decomposed asbestos. Sent by L. F. Cooper, Crescent City, Cal. 1657.

Material for assay. Sent by L. A. Rawlins, Box Elder, Colo. 1661.

Material for assay. Sent by H. W. Flagg, Martinsburg, W. Va. 1662.

Quartz stained by oxide of iron. Sent by J. Ebaugh, Hamilton, Carroll County, Md. 1666.

Supposed silver ore. Sent by Henry Clouse, Phebe, Tenn. 1668.

Rock for analysis. Sent by Theo. S. Harris, New York, N. Y. 1669.

Phosphatic rock. Sent by L. Haskell, Fort Meade, Fla. 1671.

Material for assay. Sent by H. W. Miles, Salt Lake City, Utah. 1673.

Material for determination. Sent by E. Spencer, Big Pine, Inyo County, Cal. 1677.

Eruptive Rock for determination. Sent by Robert Forrester, Scofield, Utah. 1678.

Material for analysis. Sent by S. Hummel, Gloversville, N. Y. 1679.

Supposed tin ore. Sent by Emil Wilvert, Sunbury, Pa. 1680.

Iron ore. Sent by W. W. Wotherspoon, Mount Vernon Barracks, Mount Vernon, Ala. 1681.

Material for analysis. Sent by P. F. Shumaker, Flat Creek, Winn Parish, La. 1683.

Building stone. Sent by Porter and Butler, Baker City, Oregon. 1684.

Material for examination. Sent by R. C. Stout, Caddo, Stephens County, Tex. 1686.

Supposed tin ore. Sent by Levi Allen, Salubria, Idaho. 1689.

Supposed onyx. Sent by S. Fletcher, Phebe, Tenn. 1691.

Material for examination. Sent by E. C. Kitchen, Brownwood, Tex. 1696.

Gypsum. Sent by Mrs. E. L. Smith, La Plata, N. Mex. 1699.

Ferruginous concretion. Sent by Geo. U. S. Hovey, White Church, Wyandotte County, Kans. 1790.

Volcanic dust. Sent by Sam'l Price and Thos. Finnegan, Dunlap, Graham County, Ariz. 1702.

Clay for analysis. Sent by H. Hopkins, La Fayette, Oregon. 1710.

Clay. Sent by Otto A. Benkendorf, Wilmot, Cowley County, Kans. 1711.

Conglomerate. Sent by Stewart Simpson, Ruthburg, Washington County, Idaho. 1715.

Pyrite. Sent by C. J. Hyatt, Iuka, Miss. 1728.

Supposed ore. Sent by J. S. Miller, Chewlah, Stevens County, Wash. 1722.

Minerals for determination. Sent by J. H. Pisor, Horr, Mont. 1726.

A supposed gold ore. Sent by Cassady Linthicum, Hyattstown, Montgomery County, Md. 1734.

Supposed ozocerite. Sent by Geo. S. Luce, Galesville, Wis. 1739.

Material for analysis. Sent by A. H. Bracken, Hensley, Yancey County, N. C. 1742.

Galena. Sent by H. W. Diggins, Springfield, Mo. 1747.

Material for assay. Sent by H. J. Hasbrouck, Idaho Falls, Idaho. 1752.

Sand and ore for examination. Sent by O. B. Bloom, Harrisburg, Ariz. 1756.

Material for analysis. Sent by E. B. Hassett, St. Paul, Madison County, Ark. 1758.

Minerals for determination. Sent by A. E. Lee, Alpowa, Garfield County, Wash. 1765.

Red Hematite. Sent by W. J. Stump, Hartmonsville, Mineral County, W. Va. 1767.

Material for assay. Sent by W. S. Rynearson, Indian Valley, Idaho, 1777.

SPECIAL RESEARCHES.

Little time has been at our command for special research. The Department has no chemist, and the entire determinative work falls upon the curator, who even makes a large proportion of his own analyses.

The titles of such papers as have appeared during the year are given in the Bibliography (SEC. IV).

PRESENT STATE OF COLLECTION.

The present state of the collections may be best comprehended by reference to the accompanying plan of the exhibition halls (Plate III) and the figures given below:

A.—Systematic geology.	
(1) Exhibition series	6,250
(2) Study series	12,000
B.—Economic geology.	
(1) Exhibition series	13,537
(2) Study series	4,000
Total	35,787
First catalogue entry July, 1891	67,005
Last catalogue entry June, 1892	68,049

It will be observed that the figures for the study series are the same as in my last report. This does not mean that there have in reality been no additions to this series, but rather that these additions, of which there are several very important, are not as yet properly installed. As heretofore, no attempt is made at estimating the number of specimens in the storage sheds, or of duplicate materials.

The need of additional exhibition space is even greater than at the time of my last report, and it is hoped that before the close of another year steps may be taken towards the erection of a balcony around the south-west court which will afford space for the building-stone collection. The necessity for this change was sufficiently dwelt upon in my last report.

The regular working force of the department for the year, aside from the curator, has been as follows: Mr. W. H. Newhall, aid; Miss C. Hurlburt, copyist; and Mr. J. C. Neale, preparator. Thomas Reese, laborer, has also served for a large portion of the year. Prof. R. L. Packard, who has availed himself of the opportunities offered for study during a considerable portion of the year, has rendered the department on sundry occasions, great service in determinative and analytical work.

SECTION III.

PAPERS DESCRIBING AND ILLUSTRATING COLLECTIONS IN THE U. S. NATIONAL MUSEUM.

Page.

1. Japanese Wood-cutting and Wood-cut Printing Communicated by Mr. T. Tokuno, and edited by S. R. Koehler.......... 221
2. The Relation of Biology to Geological Investigation. By Dr. Charles A. White.......... 245
3. Scientific Taxidermy for Museums. Based on a Study of the United States Government Collection. By Dr. R. W. Shufeldt.......... 369
4. The Shofar—Its Use and Origin. By Dr. Cyrus Adler.......... 437
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6. Minute Stone Implements from India. By Thomas Wilson.......... 455
7. Comparative Oölogy of North American Birds. By Dr. R. W. Shufeldt... 461

JAPANESE WOOD-CUTTING AND WOOD-CUT PRINTING.

Communicated by T. TOKUNO,

Chief of Inseteu-Kioku (Bureau of Engraving and Printing) of the Ministry of Finance, Tokio, Japan.

Edited and annotated by S. R. KOEHLER,

Curator of the Section of Graphic Arts, U. S. National Museum, Washington, D. C.

Through the kindness of Mr. T. Tokuno, Chief of the Bureau of Engraving and Printing of the Ministry of Finance, Tokio, Japan, the U. S. National Museum has received as a gift from the Imperial Government of Japan the complete outfit of a Japanese wood-cutting and wood-cut printing establishment, accompanied by illustrated descriptions of all the tools and materials sent and of the processes used by Japanese engravers and printers. The original statements made by Mr. Tokuno were supplemented by answers to questions addressed to him by me, and the patience and courtesy shown by this well-informed official can not be too highly appreciated and too warmly acknowledged. The publication of the information thus elicited will be welcomed by those who are interested in the art of the wood-cutter and in the arts of Japan, more especially as Mr. Tokuno's communication is, so far as I know, the first authoritative statement on this subject made by a native of Japan thoroughly qualified for the task. As the information which follows is scattered through a number of letters and memoranda, it will not be possible to give it absolutely in the shape in which it was received, but care will be taken to adhere as closely as possible to Mr. Tokuno's own statements. Occasional obscurities which still remain must be charged to the necessity of corresponding in English and to the great distance between the correspondents. The illustrations which accompany this paper, so far as they relate to Japanese wood-cutting and printing, were all made either from the objects themselves or from drawings by Japanese artists furnished by Mr. Tokuno. Such remarks as suggest themselves upon a comparison of our own methods, past and present, with those of Japan will be given as an appendix to Mr. Tokuno's communication.

The tools and specimens alluded to in the following pages have been placed on exhibition in the Hall of Graphic Arts, eastern side, alcove 2, in the square case on the floor of the alcove, and in frames 28 to 34.

MR. T. TOKUNO'S COMMUNICATION.

THE WOODS USED AND THEIR PREPARATION. Although "tsuge," a variety of *Buxus Japonica*, or "adsusa," *Catalpa Kæmpferi* var. *Japonica*, are employed, according to the degree of fineness of the written characters or pictures to be reproduced, the wood most generally used is "sakura," a variety of cherry. In all cases, however, the texture must be very fine and hard.

The wood is first cut into planks, and these are planed until they are perfectly level and smooth, free from all traces of the plane, and show some luster on the surface. Both sides are finished alike, as the woodcutter utilizes both of them.

Cut planks which are to be printed in black only are usually mounted between strips nailed to each end. There are several reasons for this. It prevents the warping of the planks; it gives free access to the air between them, when a number are stored on top of one another, and provides the best means of keeping them dry and guarding against damage by insects; it prevents immediate contact of the blocks, and, finally, it is sometimes very convenient, as it facilitates the drawing out of such planks as may be needed from among many stored away together, the planks being marked or numbered on the sides of the strips. For color-printing, however, the same plank often has two or three designs upon it for different tints, and consequently has registering marks on different parts. In that case the end strips would be in the way, and are, therefore, omitted.

THE TOOLS OF THE ENGRAVER. For engraving, knives and chisels of the best quality are required. All the tools needed by the engraver are represented on Plates IV (1-18) and V (19-25), and with the following explanations their uses will be readily understood:

1. Ruler for cutting straight lines and for fixing the registering marks on the planks used in color-printing.

2. Brush for removing from the plank the chips thrown out by the cutting tools.

3. Engraving knife, for cutting out the design. Only one knife, always of the same pattern and size, is used by the Japanese woodcutters, and with this one knife they perform all grades of work, from the coarsest to the finest, the execution depending entirely on the skill of the engraver. [See Fig. 1 for a Japanese wood-cutter's knife, actual size, seen from both sides.]

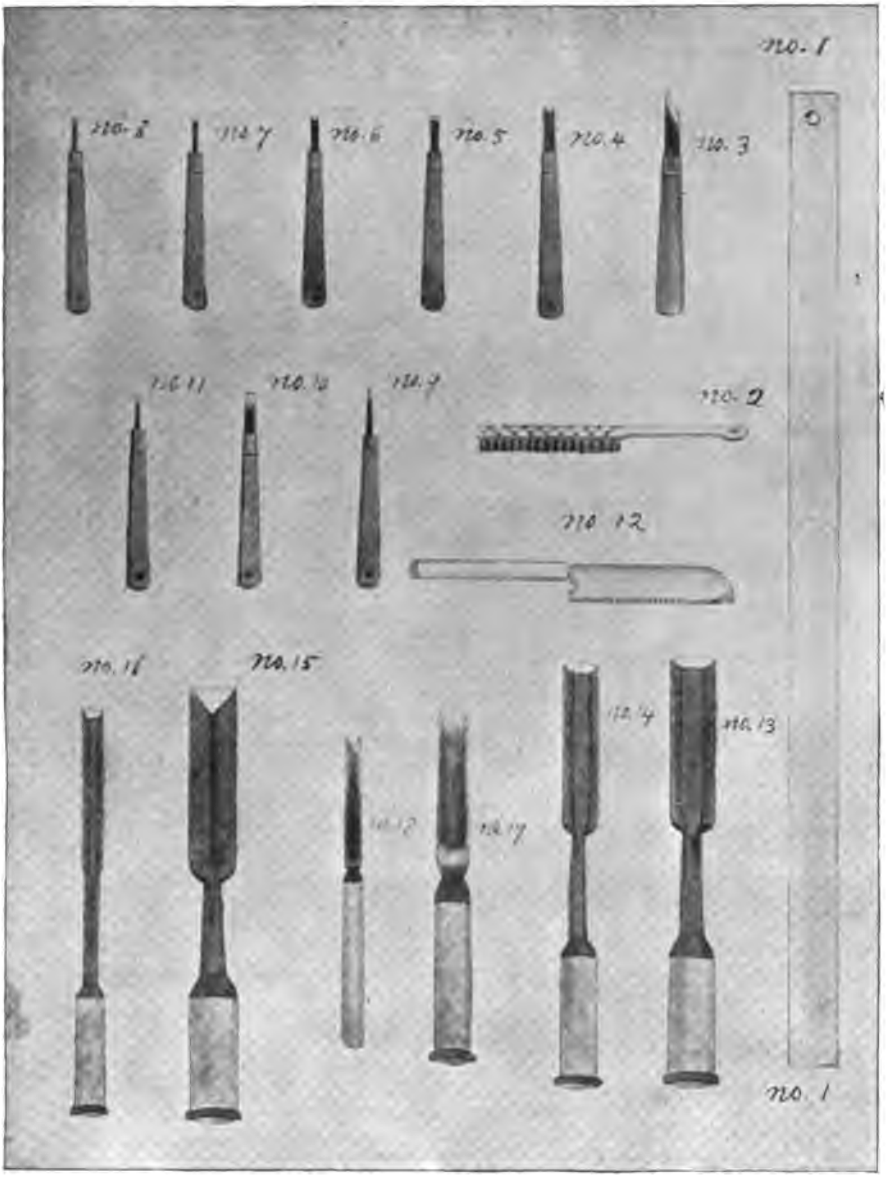
4-9. Chisels for removing smaller portions of wood between the lines of the design. They are used exactly like the engraving knife.

10, 11. Chisels for correcting unsatisfactory parts [*i. e.*, removing parts for "plugging"].

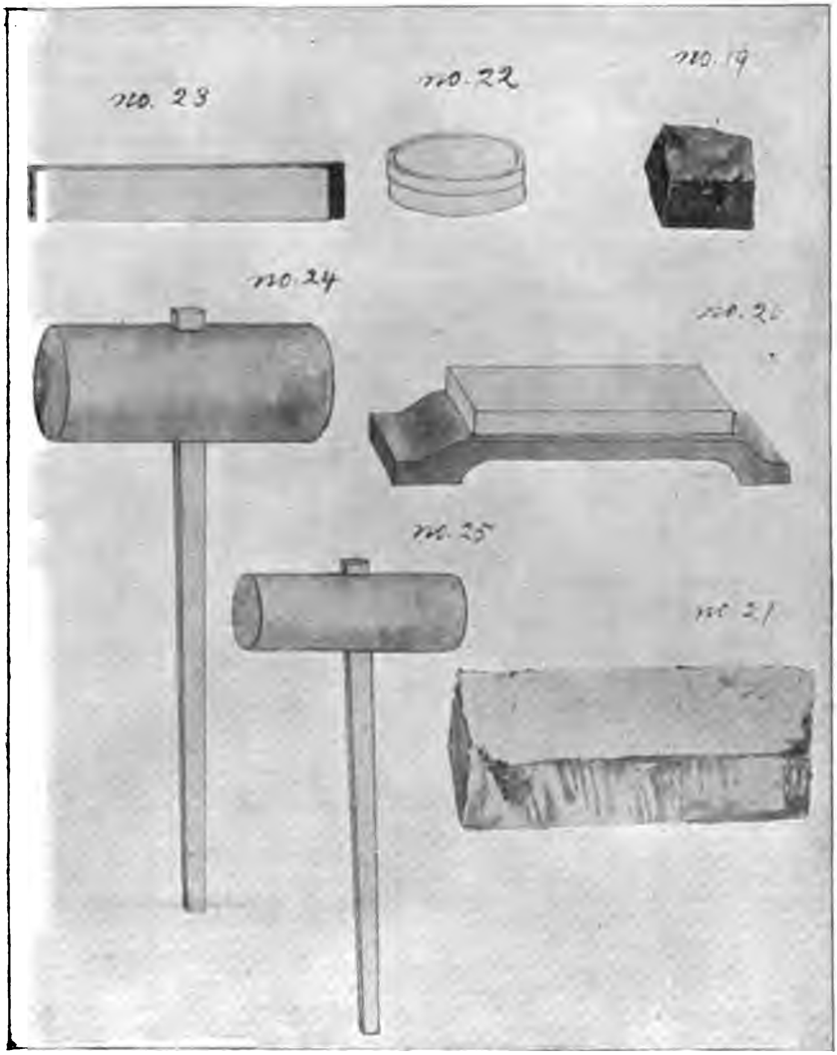
12. Saw for cutting small pieces of wood to be inserted in the plank where corrections have to be made.

13-16. Chisels for removing larger portions of wood.

17, 18. Semicircular chisels, used for the same purpose as 13-16.



Tools used by Japanese Wood-cutters.
(From a drawing in the U. S. National Museum by a Japanese artist.)



TOOLS USED BY JAPANESE WOOD-CUTTERS.
(From a drawing in the U. S. National Museum by a Japanese artist.)

19. A special kind of grinding stone, for leveling the surface of the grinding stone, No. 20.

20. Grinding stone for taking off the somewhat roughened edges of the knives and chisels, after they have been sharpened on the stone, No. 21.

21. Grinding stone. [See No. 20.]*

22. Oil pot, in which oil of *Sesamum orientale* is kept, for rubbing the portions of the plank to be cut, so as to soften the wood and make the cutting easier and cleaner.

23. Oil brush for the oil just spoken of.

24, 25. Wooden mallets for driving the chisels, Nos. 13–18.

THE ORIGINALS FURNISHED TO THE WOOD-CUTTERS, AND THE METHOD OF TRANSFERRING THEM TO THE PLANKS. Written characters or pictures to be cut on wood are drawn upon a certain kind of Japanese paper, "minogami" or "gampishi," and the drawings thus made are pasted [face downward] upon a prepared plank, by means of starch paste. The plank is now ready for the engraver. This applies to prints in black only. For color-printing, the outlines of the design are first cut and printed in black ink (Indian ink mixed with a solution of glue) upon "minogami," and the designer of the picture then marks the parts to be colored [on different sheets]. These sheets are then pasted down on the planks, as before stated, and the engraving also proceeds as before.

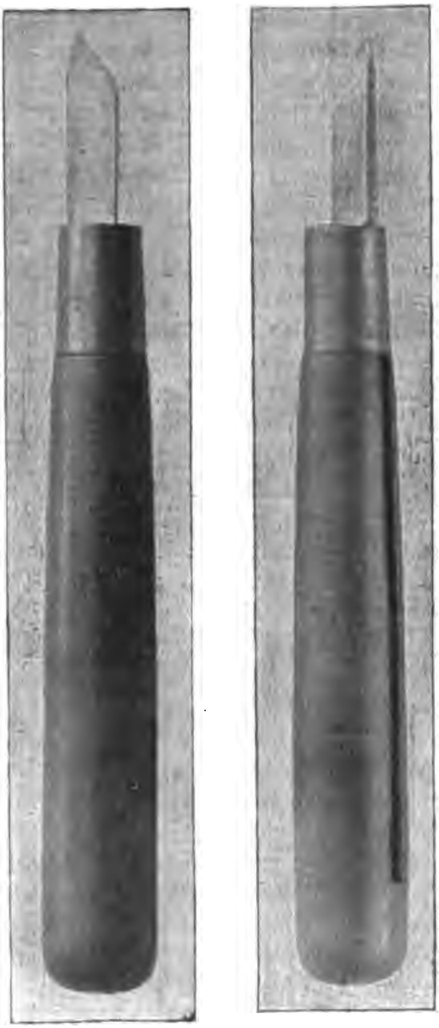


Fig. 1.

Japanese Wood-cutter's knife.

Actual size. Two views.

(From the specimen in the U. S. National Musuem.)

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* Mr. Geo. P. Merrill, curator of the Department of Geology, to whom these stones were submitted, has kindly supplied the following information concerning them:

None of them correspond exactly to the stones used for similar purposes with us. No. 19 is a dark blue-gray, fine-grained argillaceous rock, impregnated with lime, AIM OF JAPANESE WOODCUTTING. The important point to be kept in view in characteristic Japanese wood-cutting is to show the direction of the brush in painting, so as not to destroy the features of an original picture or of written characters. The direction in which the knife is moved might be said to be almost identical with the direction of the brush, and wood-cuts by skillful hands therefore show the exact features of the originals, while, at the same time, they have a special artistic character of their own.

MANNER OF HANDLING THE ENGRAVING TOOLS. The tools, having been put into good order and well sharpened, are laid on one side of the engraving table, and upon the latter is placed the plank to be cut. The wood-cutter, holding his knife in his right hand and pushing the back of it with the middle finger of the left hand, first cuts around all the lines of the design, and then removes the wood between them by means of the chisels, so as to leave the lines in relief. He then, with a small brush, cleans and washes the plank, and has a proof taken, after which he makes corrections, if necessary.

Plate VI shows a wood-cutter at work. A is the plank; B, a grinding stone for sharpening the knives and chisels; C is a box containing engraver's tools.

DIFFERENCE BETWEEN OLD AND MODERN JAPANESE METHODS OF WOOD-CUTTING. Although the method of cutting on wood differs slightly at present from the ancient method, the principal points are, nevertheless, the same.

All ancient wood-cuts are comparatively deeper than those of the present day. The shallowness of modern cutting is due, probably, to the ability to do much finer work.

In the ancient style the outer boundaries of letters or pictures were cut away deeply before they were properly engraved. At present the stages are reversed. The latter method takes less labor and time, and it is probably one of the causes of the shallow cutting at present in vogue.

Formerly the paper bearing the original design, after it had been pasted down on the plank, was oiled, so as to make it transparent, and to enable the wood-cutter to see the design quite distinctly. This is not necessary now, as it is easy to get paper sufficiently thin and transparent in itself.

Semicircular chisels are now in use for removing some of the parts between the lines of the design. There were no such chisels formerly,

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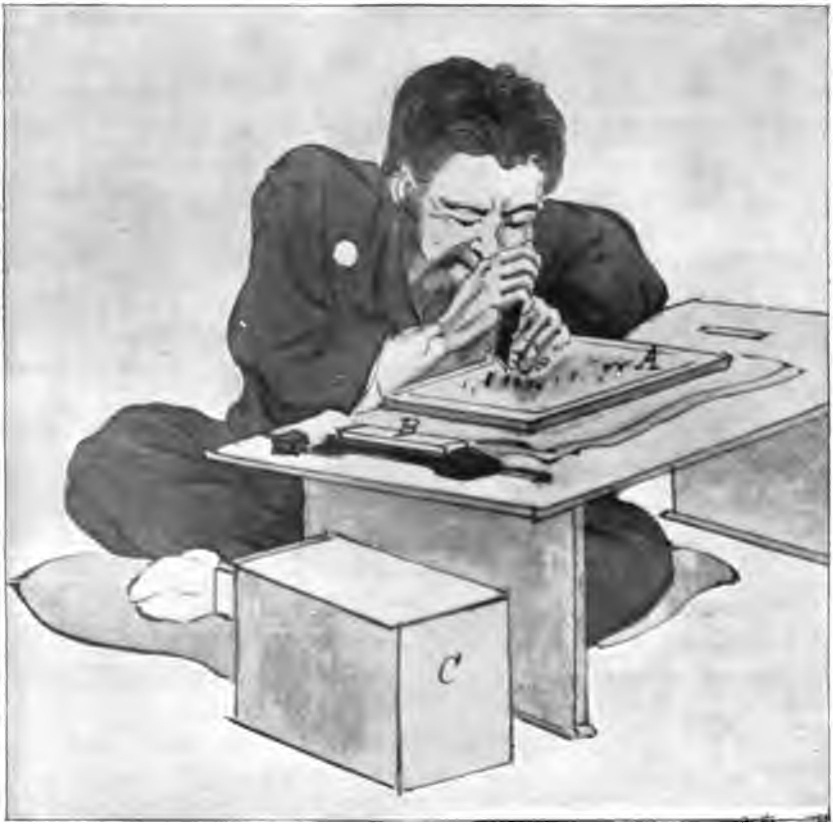
somewhat resembling our ordinary roofing slate, but softer and less finely fissiled.

No. 20 is a soft, buff-colored argillaceous rock, more like the German razor hone than anything we use.

No. 21 is a whitish, somewhat decomposed siliceous rock, rather coarse for a whetstone, giving, when breathed upon, a distinct clayey odor, indicating the presence of free argillaceous matter.



JAPANESE WOOD-CUTTER AT WORK.
(From a drawing in the U. S. National Museum by a Japanese artist.)

and hence much more time and labor was spent on this part of the work than at present.

PAPERS USED FOR PRINTING, AND THEIR TREATMENT. The papers used, whatever their quality, should be sized with a thin animal size. Among the prints sent to the U. S. National Museum are impressions on three different kinds of paper:—a special Japanese paper, made at the Insetsu-Kioku paper mills [known in America as Imperial Japanese paper], a Chinese paper, and "masa" paper.

The sheets are moistened with water before the printing begins, the degree of moisture differing according to the quality of the paper, the proper degree being determined by the judgment of the printer. "Masa" paper, for instance, on which the progressive proofs of one of the pictures ("Yinaka genji") sent to the U. S. National Museum are printed, should be very slightly moistened by means of a brush. Experiment has shown the amount of moisture in this case to be 13.86 per cent. A single wet sheet is put between every three or four dry sheets, until a suitable layer is formed, which is pressed between two wooden press-boards. When all the sheets have the proper degree of moisture they are ready for printing.

As the printing on this moist paper is done with water colors, it can be well done only by an experienced printer. The following points are to be noted: *A*. The paper should rather be under than overmoistened. If it is overmoistened the water colors will spread beyond their limits. If the paper dries during the progress of the work, wet sheets are put between the sheets to be printed, and the heap is allowed to lie until the proper degree of moisture has been obtained. If the paper is thick and strong it should be slightly moistened from the back by means of a brush. *B*. Great care must be taken not to put an excessive quantity of color on the plank. Rice paste serves well to prevent the water colors from spreading, and it ought to be used for every impression.

The printed sheets, in the interval between two printings, are laid on top of one another, to the number of many hundred sheets. If the water colors have been properly applied there is no fear of offsetting on the backs of the sheets.

A backing sheet is not generally used, but if it is desired to avoid all traces of the "baren" on the back of the printed sheets, a sheet of thin paper is used for backing.

PRINTING ON SILK.—Silk is occasionally used for printing instead of paper, and one of the specimens sent to the U. S. National Museum is on this material It is usually found necessary to mount the silk on paper, but some experts can print without this device. The silk on which one of the impressions of "Nandina domestica" is printed [in 33 colors] was mounted on paper, but only along the edge which was laid against the registering marks. When the printing was finished this edge was trimmed off.

PIGMENTS AND VEHICLES USED FOR PRINTING.—Five colors or pigments only [black, white, red, yellow, blue] are generally used for the most characteristic Japanese printing, such as the picture called "Yinaka genji,"* sent to the U. S. National Museum. They are all mixed with the necessary quantity of water, when about to be used, and the various hues, shades, and tints required are obtained by mixing the proper pigments together. These pigments, of which samples were sent to the U. S. National Museum, are the following:

a. Black, "tsūke-zumi," is generally prepared by macerating Japanese ink (a kind of India ink) in water for a few days, until the glue contained in it is dissolved, and the ink is sufficiently softened. It is then ground by means of pestle and mortar. As, however, the "tsūke-zumi" so made is very liable to deterioration, a sample of a lampblack obtained from a Japanese ink macerated in water so as to remove the glue, was sent to the U. S. National Museum. Consequently when this lampblack is to be used, and after it has been mixed with water, glue solution, or rice paste (according to the judgment of the printer) will have to be added. If glue solution is used it should be mixed with the lampblack in a basin, but if rice paste is used, that is mixed with the pigment on the plank itself by means of the brush.

b. White, "tō-no-tsuchi," is white lead. It is used either alone, for prints of flowers, birds, etc., or mixed with other colors, if light tints or body colors are wanted.

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* "Yinaka genji" is a design in black outlines with color washes. It is printed on three sheets, intended to be pasted together, each sheet measuring about 9¾ inches in breadth by 14 inches in height, printed surface, or the three sheets, when pasted together, about 29 inches in breadth by 14 inches in height. It represents a hilly landscape, in the middle ground of which agricultural operations are being carried on. Six larger figures occupy the foreground, as follows: On the first sheet are represented two richly dressed ladies, the one to the left kneeling, turned towards the right, and holding a parcel in her left hand. The one to the right stands, with the body turned towards the right, but looking down upon the kneeling figure on the left, and holding in her left hand a vessel suspended by a string. In the second or middle sheet there is another richly dressed lady, kneeling, with her body nearly fronting the spectator, while her face, shaded by the left hand, is turned up towards the group in the third sheet. In her right hand she holds a fan. On the third sheet there is a group of three figures. A man, likewise richly dressed, wearing a sword in his belt, and holding a pipe in his left hand, stands, turned somewhat towards the left, but looking back upon a lady who kneels to the right of him and makes an appealing gesture with her left hand. To the right of the kneeling lady, somewhat back of and bending down towards her, is a second lady, standing, who makes a gesture of astonishment with her left hand. Both are richly dressed. The coloring is brilliant, mostly in flat masses, with little modeling or gradation, except in the sky. The first sheet has 25 printings, the second 26, the third 23, including a "blind" impression, which produces an embossed pattern in the garment of one of the figures.

"Yinaka genji" is the title of a Japanese novel, of which this picture is an illustration, *c. Red,* "yō-kō," a kind of scarlet (imported), probably carmine. Formerly the best kind of safflower, called "ki-jō-mi," was used, but on account of its present high price the use of "yō-kō" has become quite popular.

d. Blue, "bero-ai," is Prussian blue. Formerly "ai-rō" paste, obtained by extraction from blue threads or rags dyed with indigo, or from "ai-gami," a paper saturated with indigo, was used. But since the introduction of Prussian blue from Europe its use has become quite general.

e. Yellow, "ki-wō," is orpiment. Formerly "zumi," extracted from a particular yellow wood; turmeric, "wukon-ko;" and a yellow ocher, "wo-do," were used, but orpiment has now taken their place.

For mixing these colors water only is used, but never any sizing, such as glue, except with lampblack, as before stated. A small quantity of rice paste is, however, mixed with the colors on the block or plank when color prints are to be made.

By mixing these pigments the various hues desired can be obtained, but the results will be as bright as those shown in "Yinaka genji" only in the hands of a skilled workman. There is, however, no particular method of producing these colors; the result depends entirely on the practical experience of the printer, who can judge the exact proportions of the pigments to be mixed, without using either balances or measuring glass, and who does the mixing either in his color dishes or upon the blocks themselves. Rice paste gives a peculiar luster to the colors, and much of their beauty depends upon the time and care devoted to grinding them with water. It is a fact well known to Japanese printers that skilled hands produce much finer colors with the same pigments than unskilled hands.

There is a brilliant purple [violet] in "Yinaka genji" which has been taken for an aniline color, although no aniline color has been used in the printing of this picture. The color in question was obtained by boiling a certain quantity of red (scarlet) and blue (Prussian blue), such as those just described, with water, and with proper treatment a bright purple [violet] can be obtained, almost the same as an aniline purple. This latter purple, however, has now come more generally into use, owing to the ease with which it can be managed. A brown color, formerly made by mixing red, yellow, and black, has now also been replaced by "bengara," which is a kind of red ocher.

The pigments used for printing "Nandina domestica"* are quite different from those so far spoken of, but the method of using them is the same. Following is a description of these pigments:

a. Black, "sumi," the best kind of India ink made in China or Japan

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* This picture represents a stalk with leaves and a cluster of the fruit of "Nandina domestica," a plant belonging to the Barberry family, printed on a sheet measuring 6 inches in breadth by 9¾ inches in height. It is without a background and without outlines, broadly and effectively modeled, but without any attempt at realistic rendering.

(the particular place is Nara). It is prepared for use by rubbing it with water upon the surface of a stone vessel called "suzuri," familiar to every Japanese.

b. White, "gofun," calcium carbonate [white chalk]. For use it is put in a color dish, and a few drops of glue solution are added. It is then rubbed with the finger in contact with the dish, until it becomes a wet mass and somewhat pasty. A little glue solution is again added, and the rubbing repeated, and so on several times. When the mass has become sufficiently pasty to be made into a pudding, it is beaten several times against a plank, and then reduced to a thin paste by diluting with water.

c. Pink, "sho-yen-ji." This is apparently cochineal, but its chemical nature has not yet been ascertained. It is imported from China, in the form of cotton felt dyed red. To prepare it for use this felt is put into water and gently pressed. The resulting pink water is poured into a color dish, and evaporated nearly to dryness in a water bath, or over a very slow fire, care being taken not to let it dry completely, as otherwise its brilliancy would be destroyed. It is then kept in a cool place, and protected from dust by putting a cover on the dish or by placing it upside down in a box.

d. Blue, "ai-bō," a dark blue, hard stick made of indigo. For use it is ground, like "sumi," in a color dish, with a few drops of glue solution. When a sufficiently deep blue color has been obtained, it is well rubbed with the finger in contact with the dish, and then evaporated to dryness over a slow fire. A few drops of water are now added, the dish is again placed over a slow fire, the rubbing with the finger gone through with as before, and water is added gradually, until the proper shade of color has been obtained. If these directions are not strictly followed, the pigment is not well diffused in the water, and the resulting color, as a matter of course, is not satisfactory. The treatment of the pigments *gofun, shōyen-ji, ai-bō,* etc., requires great caution, and the Japanese printers and painters consider it one of the difficulties of their art.

e. Yellow, "shi-ō." This is gamboge, and is imported. For use it is diffused in water, and no glue whatever is added.

f. Brown, "tai-sha-bō," a hard, brown stick made of a red ocher. For use it is treated exactly like "ai-bō."

g. Red, "shu," vermilion. For use it is well mixed with a few drops of glue solution, ground thoroughly with the finger, and then diluted with water to the proper consistency.

The following pigments are also used in printing, and samples of them have been sent to the U. S. National Museum:

Red, "ki-jō-mi," safflower. This color, in solution, is very apt to suffer on exposure to sunlight, and the bottle in which it is sent is, therefore, wrapped up in black paper. After it has dried on the paper, it is not so fugitive as to make it undesirable for printing.

Red ocher, "ben-gara."

Turmeric, "wakon-ko."

Yellow ocher, "wō-do."

Yellow, "zumi," extract from a particular yellow wood.

Blue, "ai-gami." Paper saturated with a solution of indigo.

Blue, "ai-rō." Indigo paste.

Of the vehicles used by the printer in the manipulation of his colors, the following is to be said:

Glue solution. The strength of this solution differs according to the different pigments, printing papers, silks, etc., to be used. About one-third of an ounce of glue to about three-fourths of a pint of water is, however, an approximate proportion.

Rice paste. This is used for both of the classes of pigments described. It is made by boiling rice flour with a certain quantity of water, and is kept in a suitable vessel. Newly made paste is preferable; old and rotten paste should not be used. The pigment to be used is put on the block or plank, and some of the paste is then added, care being taken to mix the two well and evenly by means of a brush. If the printing brushes are not charged with this paste, the brilliancy of the colors is much lessened.

THE TOOLS OF THE PRINTER. The use of these tools will be understood from the examination of Plates VII (1–4), VIII (5–17), and IX, in connection with the following explanations:

1. *Box*, for keeping all the tools and materials required for printing. The rack on top is used to hang the brushes on, and can be removed and packed in the box. The paper is kept on the shelf, so as to prevent its drying and being carried away by the draft. The colors are placed into the lower compartment. The box also serves to keep the dust and dirt from the paper and the colors.

2. *Boards*, for pressing wet paper.

3. *Small box*, for keeping colors, color dishes, etc. This is stored in the box No. 1, when not in use.

4. *Printing table*, which, when not in use, serves to close the front of box No. 1.

5–7. *Brushes*, for charging the cut planks with the printing colors, one particular brush being used for each color. When not in use, they are hung on the rack on top of box No. 1.

8. *Brush*, for wetting paper.

9. *Oil of Sesamum orientale*, contained in a bottle. (See No. 10.)

10. *Baren*, a little shield which answers the purposes of the European press. After the sheet has been laid down on the plank charged with color, it is rubbed on the back with the "baren," so as to make it take the impression. The face of the "baren" in contact with the paper is occasionally rubbed with oil of *Sesamum orientale.*

11–13. *Chisels and a knife*, used to correct the registering marks, if that should be necessary.

14. *Agitator*, for mixing colors in the basin, No. 17.

15. *Pads of cotton cloth*, to be placed under the four corners of the planks, while printing, to keep them from moving.

16. *The five dry colors* described above as used in the printing of "Yinaka genji," put up in bottles.

17. *Basin*, for mixing colors.

THE PRINTER AND PRINTING. The method of taking impressions is illustrated on Plate IX. The printer seats himself, and arranges all the tools and materials required, in good order, as shown. The plank to be printed is placed on the printer's table A, and the required color is laid on with the brush B. The paper being ready for printing, and having been placed upon the shelf C of the box D, a sheet of it is laid down upon the plank, and is rubbed lightly with the "baren" E. The printed sheet is then placed on a board which rests upon the box F, used for keeping colors, color dishes, etc., and when the required number of sheets has been printed, they are put back on the shelf C. Another plank is now taken, the second impression is made upon the sheets bearing the first, and this is followed by the third, fourth, etc., until the printing is completed.

Charging the block with color. ["Inking" the block.] As before stated, the pigment to be used is put on the block or plank, and some rice paste is then sprinkled upon it. It is well, also, to soak the brush properly with this paste, so as to mix it thoroughly with the pigment. This increases the brilliancy of the colors, and also fixes them more completely.

Dry impression. [Embossing.] There is a special kind of printing, called "dry impression." This is used when it is desired to represent designs of the same color as the ground, but differing in brilliancy. It is executed after the printing has been finished, and the paper has become quite dry. The sheet is then laid upon a plank specially cut for the purpose, but not charged with color, and is rubbed with the "baren."*

The "baren" and the method of using it. The "baren" (see Plate X *a–d*) is a little hard shield, *d*, consisting of a stiff disk *a*, made of layers of paper pasted together, and turned up at the edge so as to form a very shallow receptacle, and covered with cotton cloth on the outside. A second disk *b*, formed of twisted cord, fits into this shallow receptacle, and is held in place by the bamboo sheath *c*, made of the ribbed leaf of the bamboo, which is drawn tightly over it and twisted together on the back, so as to form a handle. This latter is made more convenient for the hand to grasp it by a strip of paper wound around it and so arranged as to assume the shape of a rectangular pad.† The

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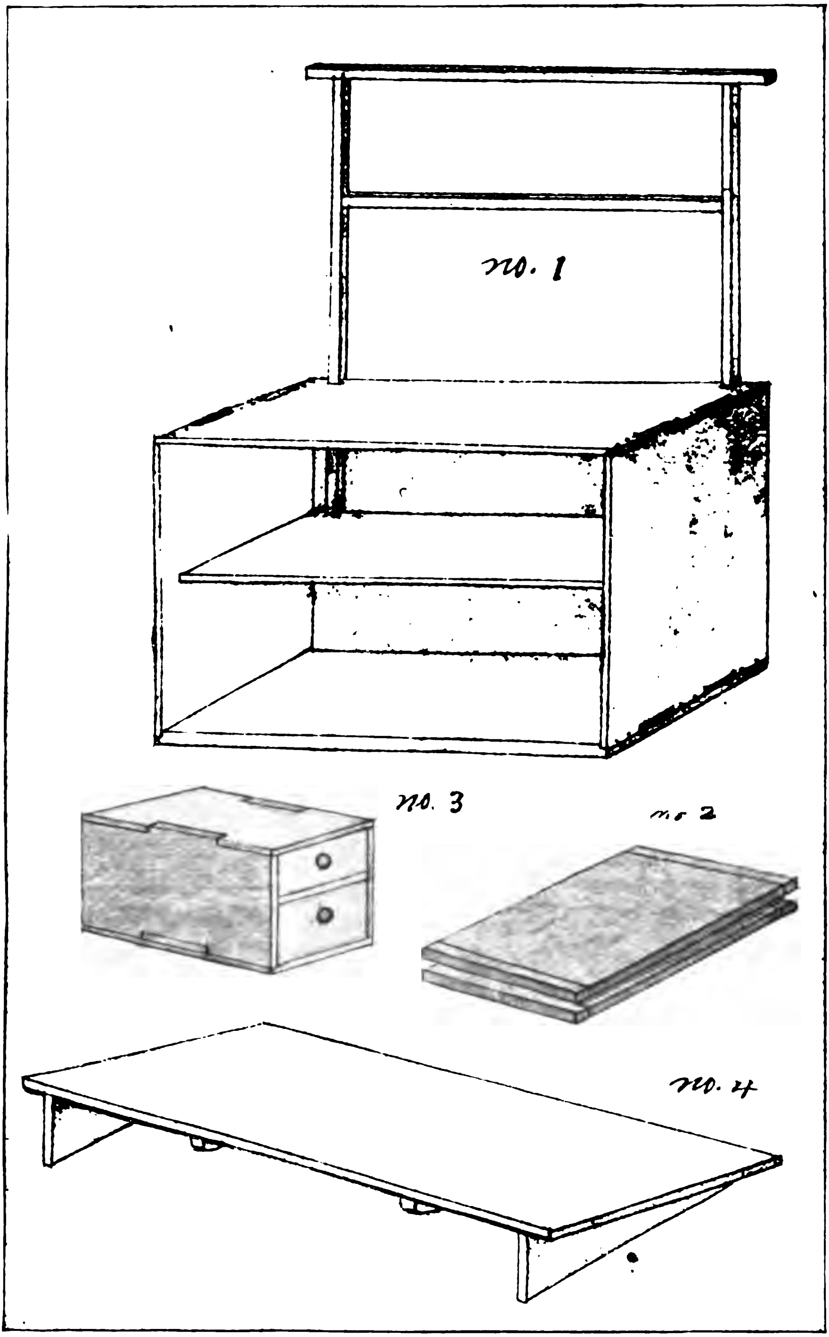
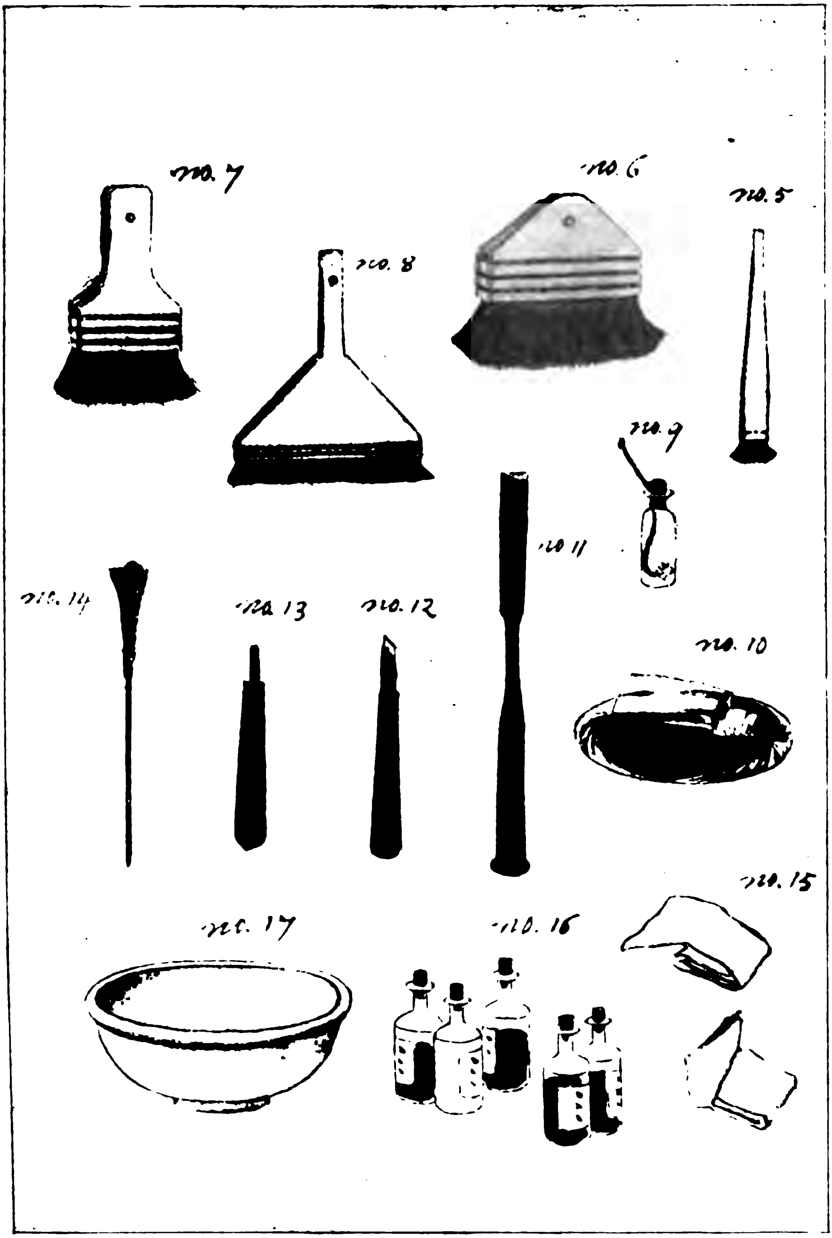
* Some specimens in the U. S. National Museum show, however, that this embossing is occasionally done before the printing is finished.

† This description is based upon the object itself, rather than upon Mr. Tokuno's notes.



TOOLS AND APPLIANCES USED BY JAPANESE WOOD-CUT PRINTERS.
(From a drawing in the U. S. National Museum by a Japanese artist.)



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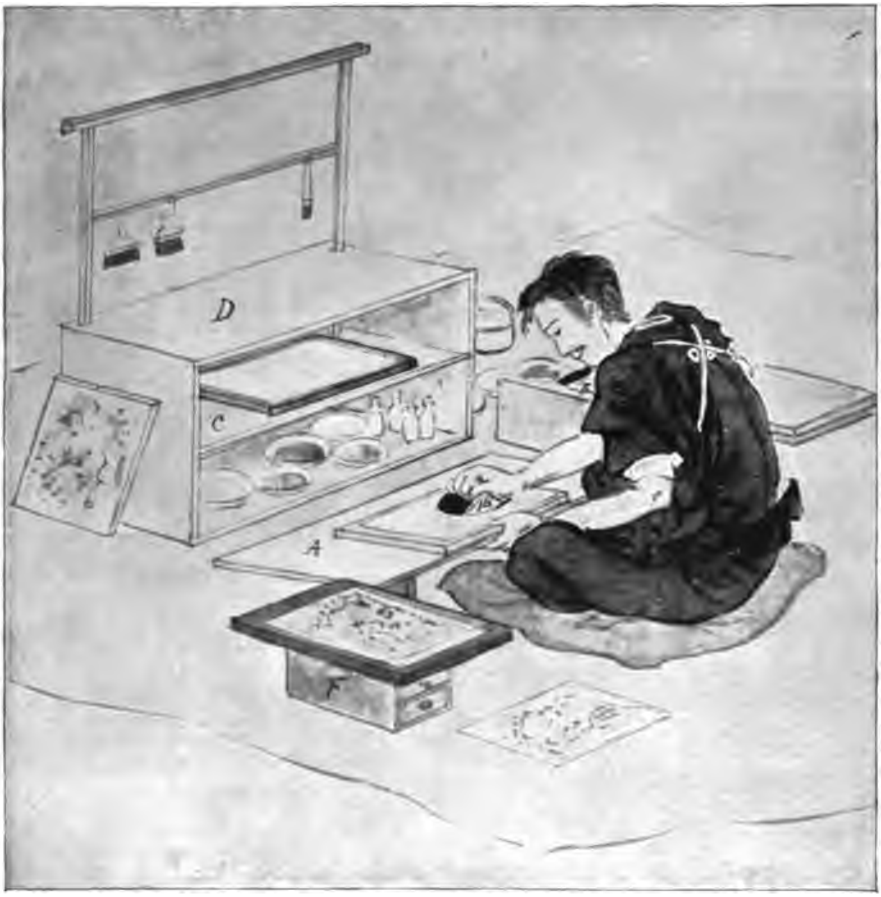
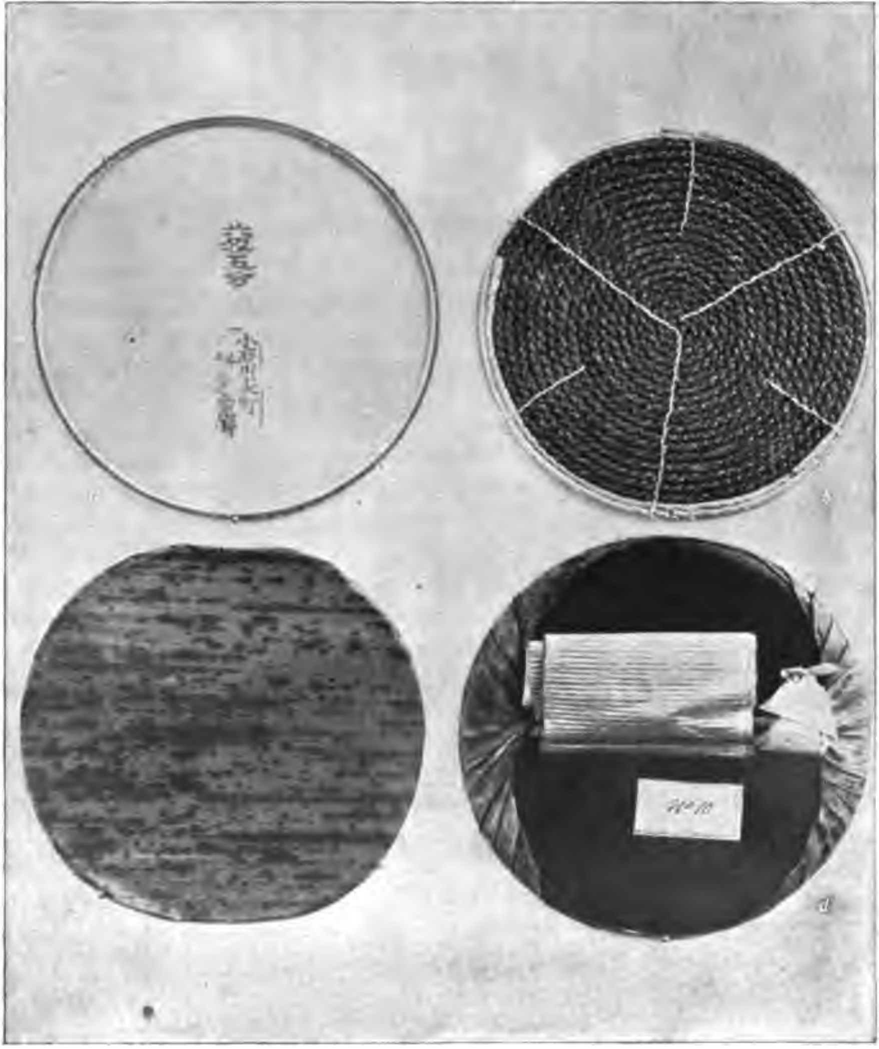


A JAPANESE WOOD-CUT PRINTER AT WORK.

(From a drawing in the U. S. National Museum by a Japanese artist.)



BAREN AND ITS PARTS.

(Reduced in size. Actual size, 5¼ inches diameter.)

a. The stiff rimmed disc, which holds the corded disc ; *b*, the disc of twisted cord; *c*, the bamboo sheath; *d*, baren complete, seen from the back, showing the handle, with the strip of paper wound around it.

(From specimens in the U. S. National Museum.)

reason why it is made so hard, besides making the filling of twisted cord, is to prevent its bending during use. Moreover, if it were not so hard and rigid, the full stretching of the bamboo sheath would be impossible. The ribbed surface of the bamboo serves not only to get a sharper impression, by limiting the contact to the ribs, but it also prevents the adhesion of the wet paper to the "baren," which would occur, to the spoiling of the paper, if the covering were smooth. The contacting surface should be applied only to those parts of the plank which have been left standing in relief. If this precaution is neglected, there is the possibility of smearing from the depressed parts of the block. The direction in the movement of the "baren" should be zigzag, as shown on Plate XI, but if a very small and isolated part of the design is to be printed, it is better to give a lighter rub with the edge of the instrument. On Plate XII the dotted line shows the direction of the "baren," while the solid curved lines mark the outlines of the design. The rib of the bamboo sheath should be kept as nearly as possible at a right angle to the direction of the "baren."

Smearing from the depressions of the block. As the depressions of the cut planks—that is to say, those parts which have been cut away between the lines and masses of the design—are rather shallow, and at the same time in many cases quite extensive, it would seem almost impossible to prevent the sinking of the sheet into the depressions and taking the color in these places, more especially when the method of applying the printing color with a brush is considered, which makes it impossible to keep the depressions clean. Experienced printers, nevertheless, work without fear of smearing, and no special precautions are used to guard against it.

Registering. As each color requires a separate cut, each plank must have certain fixed marks [registering marks], so that all the sheets may be laid down in exactly the same position, to insure the fitting of each color upon the others. No mechanical means whatever are used, either in placing the sheet, or for holding it in position after it has been placed. The Japanese printer, in these matters as in all others, depends simply upon experience. The manner of placing the sheet on the block is shown on Plate XIII. The same figure shows also the registering marks on the block or plank, which consist of a rectangular notch ▁▁▁▁▕ at the right, and a straight notch ——— at the left.

General remarks about printing. The printing may differ in quality, but the method employed is always about the same. The printing of a picture like "Nandina domestica" [which is an imitation of a water-color painting without outlines] requires, of course, greater skill than the printing of "Yinaka genji" [which is a drawing in outlines, with color washes]. The aim in this case is to produce impressions which an inexperienced eye can hardly distinguish from the original. But there is no special way of treating either class of prints. The difference between the best and the less good is due entirely to the skill of the printer in producing the various hues, tints, and shades with printing brushes, in precisely the same way as the water-color painter. This holds good also of the engraver. The arts of engraving and of printing are practiced in Japan according to the dictates of experience, with no, or at the most but very slight, mechanical assistance.

COST OF DESIGNS. The original design of "Yinaka genji," by Kuniteru, called also Yichiyusai, cost 10 yen (about $7.60).

That of "Nandina domestica," by Chinzan, Tsubaki, cost the same sum.

COST OF ENGRAVING. "Yinaka genji," engraved by Kōkichirō, Morikawa, cost 16 yen (about $12.30), and took the engraver about 20 days. [The three sheets, executed respectively in 25, 26, and 23 printings, or in all 74 printings, required the cutting of 37 blocks. See the notes by the editor, p. 240, concerning the discrepancy between number of printings and number of blocks.]

"Nandina domestica," engraved by Kōtarō, Kido, cost 8.4 yen (about $6.38), and took about seven days in the doing. [There are 33 printings, but the number of blocks used is not stated.]

COST OF PRINTING. The printer of "Yinaka genji," Tsurūsabrō, Nakamura, received 70 sen (about 54 cents) per day. He printed 3,000 sheets per day from the black block, and 700 to 800 sheets per day from the color blocks.

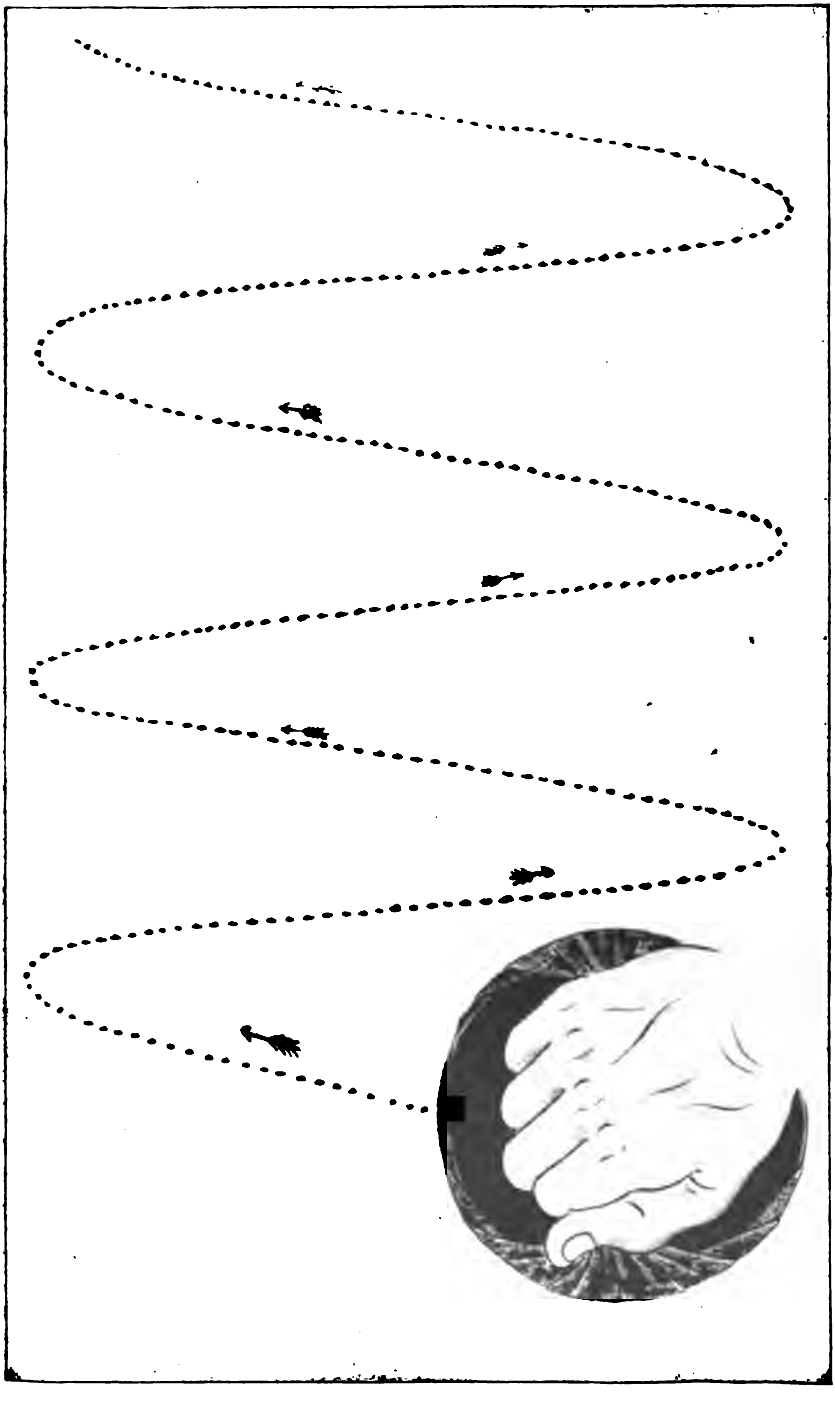
The printer of "Nandina domestica," Yiwakichi, Yamamoto, received one yen (about 76 cents) per day. He finished about 200 sheets per week.

The people engaged in home industries do not generally take a rest on Sunday. The week, therefore, has seven days of about eight hours each. As "Nandina domestica" has 33 printings, 200 finished sheets are equal to 6,600 impressions per week, or 943 per day. The numbers differ, however, according to the different nature of the blocks. Of the easiest, for instance, such as a uniform green for the leaves, 1,200 to 1,800 sheets can be printed in a day, while of the most difficult ones, such as those giving the half-tints in the fruit, only 600 to 700 sheets can be printed.

NOTES BY THE EDITOR.

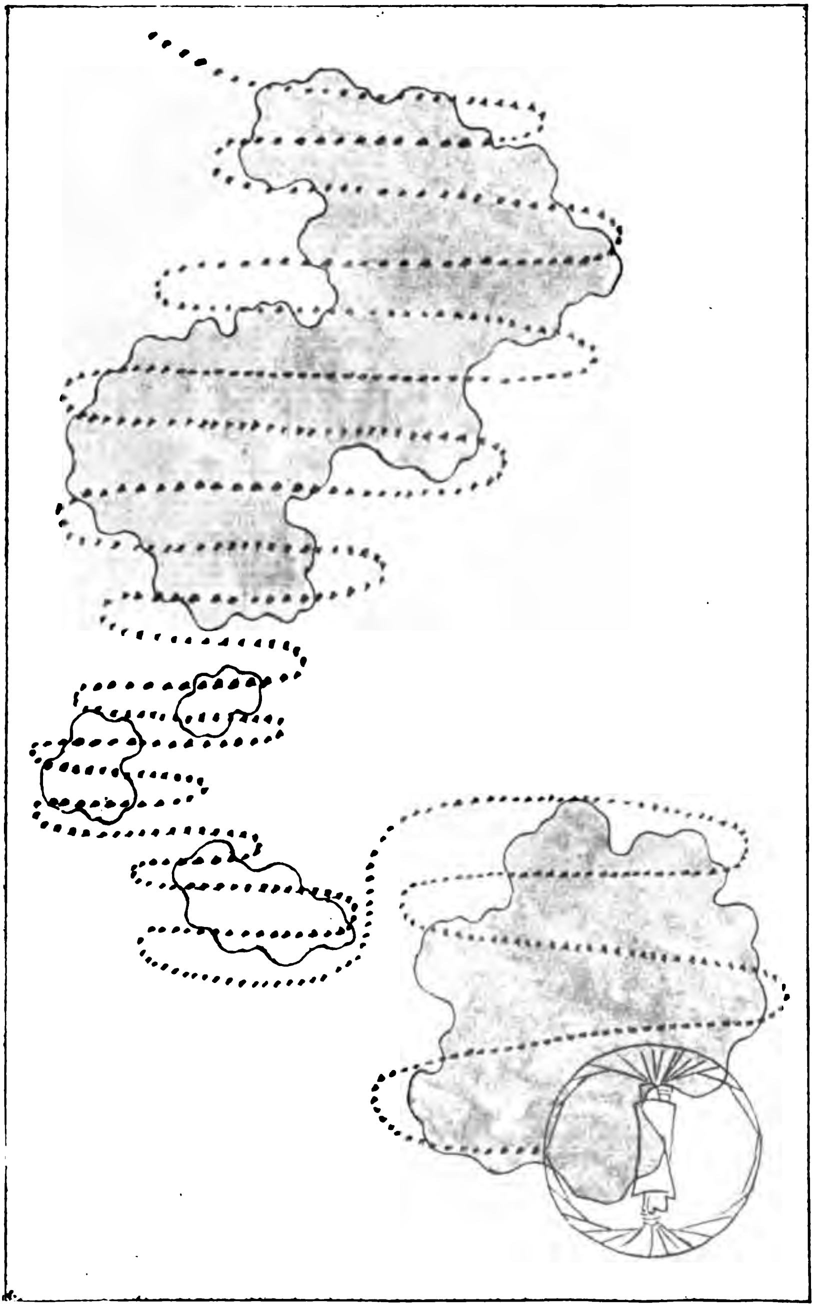
To any one familiar with the history of the technique of relief engraving, the reading of Mr. Tokuno's communication makes it evident that the methods used by the Japanese engravers of to-day, so far as they have not been influenced by European precept, are precisely those used in Europe in the 15th, 16th and 17th centuries. In other words, these artists are not, correctly speaking, wood-*engravers*, but wood-*cutters*. This is apparent from the material and the tools used by them.

The material is wood *cut in the direction of the fiber*, *i. e.*, *planks*, for which, since Bewick's time, *blocks cut across the fiber* or grain have been substituted with us.



METHOD OF USING BAREN.

(From a drawing in the U. S. National Museum by a Japanese artist.)



METHOD OF USING BAREN.

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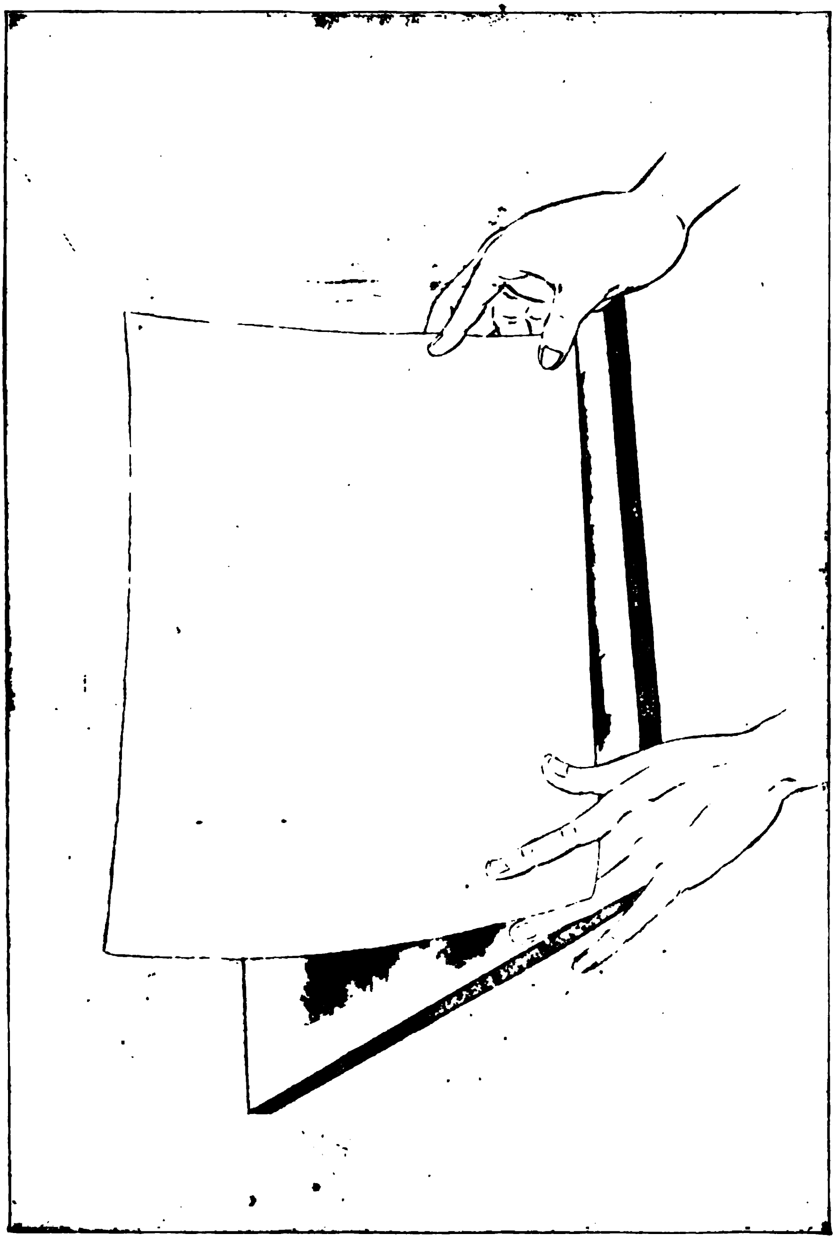

REGISTERING.

(From a drawing in the U. S. National Museum by a Japanese artist.)

The tools are *knives*, which with us have been displaced by *gravers*.

It is interesting to compare the representation of a Japanese wood-cutter (Pl. VI) with the oldest known representation of a European wood-cutter (Fig. 2), here reproduced from Jost Amman's "Beschreibung aller Stände" (generally, although not quite correctly, called "Book of Trades"), published in Frankfort-on-the-Main in the year 1568. As Jost Amman was a very prolific designer for wood-cutters, he must have been thoroughly familiar with the craft, and his representation may therefore be accepted as reliable. At first sight the way of holding the tool adopted by Amman's "Formschneider" (form-cutter, *i. e.*, wood-cutter) impresses one as peculiar, and perhaps unwarranted. A glance at Pl. VI, however, shows a striking analogy between the manner of holding the tool of the Japanese "Formschneider" of to-day and that of his European predecessor of the sixteenth century, *i. e.*, they both hold the tool perpendicularly, the only difference being that the Asiatic uses also the left hand in guiding it. The modern Japanese document may therefore serve to confirm the correctness of Jost Amman's delineation.

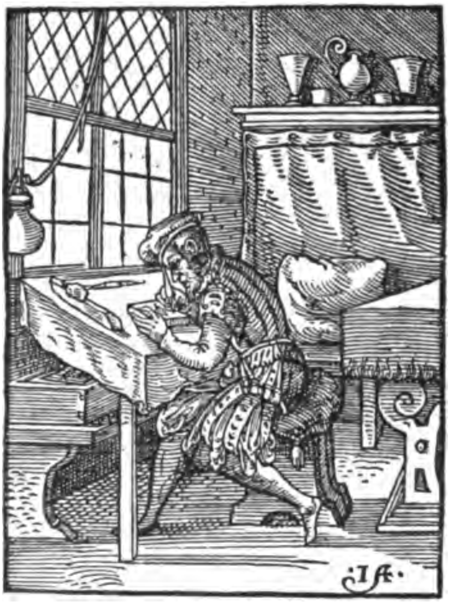

Fig. 2.

A EUROPEAN WOOD-CUTTER OF THE XVI. CENTURY.

(From Jost Amman's "Book of Trades," 1568.)

Of the shape of the knife used by the old wood-cutters of Europe and of the way of grinding it, we have no positive knowledge, as the representations of tools which often accompany the monograms of the "Formschneider" on sixteenth century wood-cuts are too small, and oftentimes too fantastic, to be of any use for information. The knives or "engraving points," as he called them, used by J. M. Papillon, the well-known French wood-cutter of the eighteenth century, are figured and fully described in his "Traité de la Gravure en Bois," 2 volumes, Paris, 1766. The blades were made of clock springs mounted in split wooden handles, in which they were fastened by means of a piece of string wound around them. Fig. 3 shows one of these knives, actual size, reproduced from Pl. IV in Papillon's second volume. It is flat on the side not shown in the illustration, beveled on the side shown, and cut off obliquely at the extremity. The straight edge is the cutting edge. The Japanese knife (see Fig. 1) at first sight seems to be similarly constructed. Its blade is, indeed, heavier, but it is mounted in a somewhat similar handle, not split, however, but with only a slit in it, into which the blade is wedged, and in which it is held in place by a ferrule.[*] It is furthermore beveled on one side like Papillon's knife; but the bevel is on the opposite side, and there is a bevel also along the edge which forms an angle with the long edge of the knife. This is necessary, because the cutting edge is the short oblique one and not the long edge. That this is so is apparent from the way in which the Japanese wood-cutter holds the knife on Pl. VI.

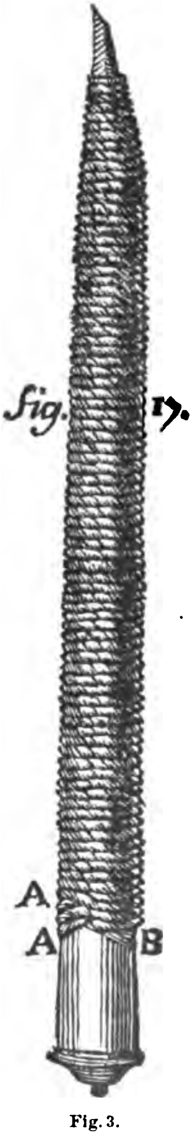

Fig. 3.
THE KNIFE USED BY PAPILLON.
(From his "Traité," 1766.)

It is worth remarking that Papillon's way of holding the knife differed radically from that of his European predecessors and of the Japanese wood-cutters of to-day. Fig. 4, also taken from Papillon's second volume, illustrates this point.

In the method of transferring the design to the plank, we again find a close analogy; for although the early wood-cut draftsmen of Europe in most cases, probably, drew their designs directly on the wood with pen and ink, it is well known also that sometimes the drawing was made on a sheet of paper and pasted on the plank, face downward, in precisely the way which is practiced in Japan at present.

Still more curious, however, is the similarity between the instrument, "baren," used by the printers of Japan, and the earliest contrivance for taking impressions from cut blocks, of which mention is made, so far as at present known, in a European book. The "baren" has the form of a little shield. In the treatise on painting, written by Cennino Cennini da Colle di Valdelse, towards the close of the fourteenth century, chapter 173, entitled "How to paint on cloth with a form," the following directions are given: A wood block upon which the design has been cut is to be charged with color. For this purpose a glove is to be worn on the left hand, the color to be used is to be spread on the palm of the hand, and the block is then to be charged with the color, "carefully, so that the parts cut out do not fill up," the gloved hand doing the office of a printer's ball. The cloth is now to be laid on the block charged with color, and then, continues Cennini, "take a shield of wood in the right and press with the back upon the surface, so far as the cut plank will bear it."* It is, however, apparent from this most summary description that Cennini's rude contrivance is not to be compared for efficiency with the Japanese "baren," with its twisted cord packing and ribbed bamboo sheath. Nor does the printing shield mentioned by Cennini seem to have come largely into use, for the instruments generally supposed to have been employed in Europe for taking impressions previous to the introduction of the press are rubbers (which, however, might have been shield-shaped) and rollers, of which the latter remained in use for the taking of

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[*] Papillon also describes this arrangement, but prefers the one shown in Fig. 3.

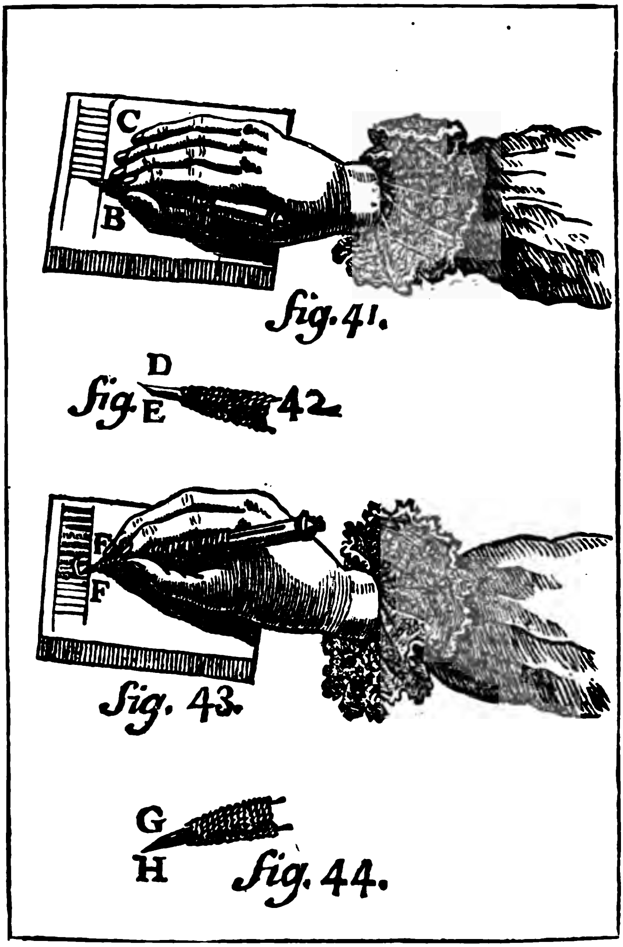

Fig 4.

PAPILLON'S MANNER OF HOLDING THE KNIFE.

(From his "Traité," 1766.)

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* Quoted from Ilg's translation, in Quellenschriften der Kunstgeschichte, Vol. I, Vienna, 1871, p. 122.

proofs down to the time of Papillon, who describes and figures them in the book before cited.

That the method of plugging practiced by the Japanese wood-cutters—evidently by square instead of round plugs—is the same as the old European method is not to be wondered at in view of the identity of the materials used.

With these elementary factors of materials, tools, and appliances, the similarity between Japanese and sixteenth century European wood-cutting ends, however, and further examination discloses differences of a very marked kind.

It is well-known that the work of the old European wood-cutters is essentially black-line facsimile, *i. e.*, the reproduction, more or less faithfully, of drawings in black lines, generally pen-and-ink drawings, on a light ground. It was this limitation which threw the wood-cut out of the race with the other reproductive arts, until it was enabled to enter the lists again after it had been transformed into wood-engraving. The wood-cutters and printers of Europe did, indeed, attempt to produce color effects as early as 1457, this being the year in which appeared Fust and Schoeffer's Psalter, the first dated printed book, so far as we know, and at the same time the first dated piece of color-printing. This, however, was merely work of a decorative character. The first pictures really printed in colors are Cranach's chiaroscuros, the oldest of which are dated 1506, and, of works printed in positive colors, Jost de Negker's portrait of Jacob Fugger, about 1512, and Altdorfer's Beautiful Maria of Ratisbonne, about 1519. But of these two kinds of productions, only the first, the chiaroscuros (clairobscurs, Helldunkel)—that is to say, imitations of India ink and sepia drawings and other monochromes—came largely into use during the sixteenth, seventeenth, and eighteenth centuries, while the attempts to introduce printing from relief blocks in positive colors, although renewed from time to time, never succeeded to any extent, so that it may be said even to-day that chromoxylography is practiced only occasionally, except for such coarse work as advertisements, show bills, etc.*

The Japanese, as a matter of course, have also produced and still produce facsimiles of drawings in black lines, but owing, possibly, to the fact that their artists use the brush instead of the pen or some still more unyielding point, they were soon led to attempt the reproduction of washed drawings, not only in black and grays, but also in positive colors. Their earliest productions of this kind do not, indeed, according to Prof. Fenollosa, go back beyond about the year 1745,† but they made up for their later appearance in the field by a prodigious activity and a superb facility of execution—within the limitations of their art—that far outstripped the isolated achievements of their earlier European colleagues.

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* As these notes treat only of relief printing no account is taken here of chromo-chalcography and chromolithography.

†There is considerable variation in the statements found in books concerning the oldest specimens of Japanese color-printing. From Dr. Justus Brinckmann's Kunst und Handwerk in Japan (Berlin, 1889, p. 222), we learn that these specimens, according to a Japanese author, Sakakiwara, date from the year 1695, although on p. 237

We have seen that, according to Mr. Tokuno, the highest aim of Japanese chromoxylography is the imitation of the original, even to the sweep of the brush, so close that an inexperienced eye shall find it difficult to tell the printed counterfeit from the painting made by the hand of the artist, and it must be admitted that the wood cutters and printers of Japan have been wonderfully successful in their efforts, not only in the reproduction of black-and-whites, for which, also, several printings are generally used, but quite as much with designs in color. It is true, certainly, that Japanese painting lends itself more easily to deceptive imitation than European painting; but there is still another cause to be assigned for the success of Japanese color-printing in this respect, and that is the method of printing practiced by the Japanese, or, more correctly speaking, their method of charging ("inking") the block.*

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of the same book it is stated that Torii Kiyonobu, who was not born until 1688, was the first painter who had his designs reproduced by color-printing. According to Theodore Duret (see Chronik für vervielfältigende Kunst, 1889, No. 6), the first color-prints with two or three tints were produced between 1710 and 1720. Finally, according to Dr. Wm. Anderson, the author of the Catalogue of Prints and Books illustrating the History of Engraving in Japan, issued by the Burlington Fine Arts Club in 1888, the date is about the year 1700 (see p. XVII of the catalogue named). Prof. Fenollosa, however, is of opinion that these earlier specimens were not color-prints, but colored prints, *i. e.*, prints tinted by hand.

* Dr. Brinckmann, p. 230 of the book previously quoted, says that in Japan "we look in vain for the painted types of the color-prints, since the artist who works for color-printing creates independent works of art by its means," while, on the contrary, he says of us that we claim triumphantly to have reached our aim in reproduction "when it becomes impossible to tell the original from the copy without close investigation." Dr. Brinckmann, indeed, contradicts himself, when, on p. 288, he speaks of the publication of the paintings of Korin and of his brother Kenzan, a celebrated ceramic artist, by Hoitsu, about a century after the death of these artists, and Mr. Tokuno's statement that the highest aim of Japanese printing "is to produce impressions which an inexperienced eye can hardly distinguish from the original," certainly shows that the first statement made by the author named, however broadly it may apply to certain kinds of printing, is not true absolutely. Moreover, among the specimens sent to the U. S. National Museum by Mr. Tokuno, there are several reproductions of paintings, including a book in two volumes, "Shū bi gwa kan," or reduced copies of pictures drawn by eminent old artists of the Kioto or Shijo school.

Color-prints made without painted originals to work from are also found among our own productions, although they are of a subordinate rank and do not aspire to rival the brilliant productions of the Japanese color-printers. Sketches in color are rarely made for the colored pictures in the comic journals like "Puck." These pictures are printed from four stones, one giving the design and modelling in black or brown, the other three supplying the coloring by means of Iris tints, two running in one direction, the third at right angles to it, and these Iris tints are mostly adjusted on the press under the direction of the designer, without an original by

The old printers of Europe, down to the beginning of this century, inked their blocks with printer's balls, such as are shown in Fig. 5, reproduced from Jost Amman's "Charta Lusoria," published at Nuremberg in the year 1588. The custom of the present day is to use elastic rollers, made of a mass consisting of glue, molasses, etc. On our steam presses the inking is also done by rollers. The ink used in all cases is linseed-oil varnish, with which the pigment has been ground up. Water-colors have, indeed, been tried for printing occasionally, but practically without success, except for the printing of wall papers. The Japanese printers, on the contrary, so far as they have not been affected by European methods, use nothing but water-colors, and instead of balls or rollers they employ brushes, that is to say, they paint their blocks. There is a very obvious advantage in the use of water-colors by the Japanese printers, as all the originals to be imitated by them are painted in water-colors. It is evident that the brilliancy and quality of the pigments are the same in original and copy, while the pigments which we use for our chromoxylographic and chromolithographic printing, being mixed with linseed-oil varnish, are affected by it in their purity as well as in their surface quality. The use of a brush instead of a roller for inking the blocks is also a factor of great importance. The brush is a pliable instrument, capable of expression in

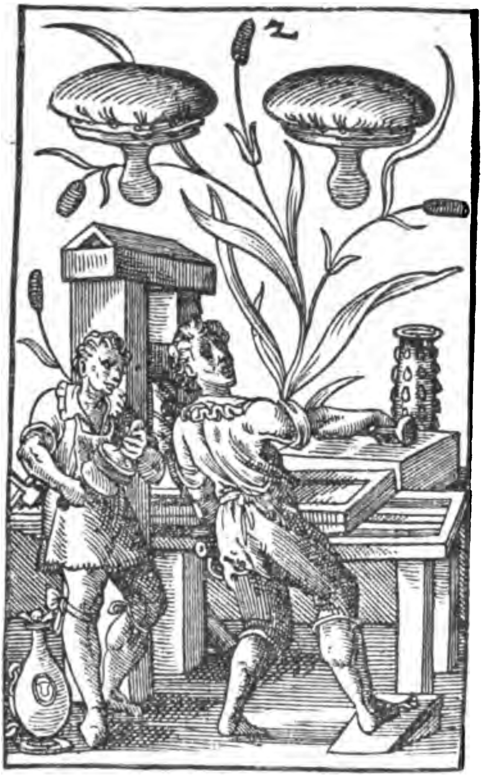

Fig. 5.

TWO OF PRINTERS' BALLS.

(From Jost Amman's "Charta Lusoria," 1588.)

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which to be guided. A small specimen of this kind is shown in Frame 67 A, on the eastern side of the Hall of Graphic Arts. Much more brilliant work has, however, been done by the same means. The old chiaroscuro printers were also in a measure independent of the artist, not only sometimes adding tints to designs by artists long dead, but varying these tints for the same picture. The tint blocks for Dürer's portrait of Varnbuler, for instance, were added after his death, and there are impressions in brownish and in greenish tints. In this case the liberties taken by the printer were permissible, from the same cause which favors the Japanese color-printers, that is to say, because the coloring and lighting of the old chiaroscuros are purely conventional.

the hands of an intelligent being. The roller, on the contrary, even in the hands of the most skilled printer, is much less pliable, and on the steam press it is without any pliancy. This quality has, indeed, become a merit in the steam press, so that it is now looked upon as more reliable than the hand press. But this is true only in so far as uniformity of result in the impressions is concerned. The artist can do nothing with it, while with a bare block or plate and a brush full of color he can do wonders. We have seen this of late years in the renewed development of the monotype, and it may, indeed, be said of Japanese printing that it involves, at least in its best productions, the principle of the monotype. It follows from this that the Japanese printer must be something of an artist. In the words of Mr. Tokuno, he must have the skill to produce "the various hues and shades with printing brushes, in precisely the same way as the water-color painters do."

As the color is laid on the block with the brush, the facilities offered by this tool can, as a matter of course, be utilized, and are utilized to their fullest extent, by the Japanese printer. He can deposit more or less pigment on the block, according as he may need a stronger or a more delicate tint, and he can even produce gradations on it quite independent of the wood-cutter; that is to say, on a perfectly flat block. All the gradations from light to dark seen in Japanese color-prints are the result of the printer's brush used on the block, assisted sometimes, it is said, by wiping with the finger. The roller which we use for inking our blocks is not capable of producing such gradations,* as it deposits a uniform film of ink all over the surface. The consequence is that with us the gradations are produced by the engraver, who cuts away more and more of the wood, either in lines or in dots, as he proceeds from dark through lighter tints to white, while the Japanese wood-cutter furnishes to the printer blocks which are solid even in those parts which in the impression are to be gradated. It follows that what we call "engraved tints," either flat or gradated, are never seen in purely Japanese wood-cuts. The blocks offer nothing but flat masses, and such lines as appear in them serve merely to bring out the forms, patterns of stuffs, textures, etc. Whenever a European engraver has to render a sky gradated simply from a darker blue, through lighter tints downward, and finally merging into a tint so light that he must express it by white, he cuts a series of white lines, narrower and farther apart where the color is to be strongest, and gradually increasing in width and nearness as it decreases in strength, until, where the white paper is to show, he cuts away all the wood. His Japanese colleague, on the contrary, gives the printer a flat block, on which those parts merely are cut away which correspond to objects seen against the sky, such as trees, mountains, houses, etc., and which, therefore, must be kept free from the blue of the sky behind them. On this block the printer paints the gradations needed, and if he can not get a satisfactory result with one printing, he uses the same block twice, only varying the "inking." In the picture "Yinaka genji," for instance, the sky is printed once with a gradation reaching from the top of the picture to about the middle of the sky, and again a second time with a gradation reaching considerably farther down. It is evident that the upper part of the sky may thus be strengthened, and the gradual shading-off into the white along the horizon made still more gradual.

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*Except in "Iris printing," which, however, need not be considered here.

From what has just been said, it is apparent that the same block may be used twice on the same picture. This is true not only of the printing of skies, but the same device is resorted to also in other parts of the design. A block may be printed in a flat tint or color the first time, and it may then be charged a second time with another color, say a gray, but gradated, and printed on top of the first color to produce modulations. The number of planks cut for a Japanese color-print, therefore, is very far from corresponding to the number of printings. It is, moreover, reduced still further by painting the same block with different colors in different parts. These colors may, indeed, be printed at the same time,[*] but it happens frequently that they are used separately; that is to say, that the block is painted and printed in part only, and then laid aside, to be taken up again later and painted on those parts which were left uninked before. Thus of the three sheets which together make up the picture "Yinaka genji," the first has 25 impressions, the second 26, the third 23. Of blocks used, however, there are only 13 for the first, 10 for the second, and 14 for the third, or 37 cuts, executed on 21 planks, for 74 printings.

It is seen from the number of impressions needed for the completion of the picture just alluded to, that the Japanese printers are not bent on saving labor in this respect, a fact which is occasionally shown in a most curious manner, as when a single pair of red lips is printed by itself in a flat red, although several other red blocks are used for the same picture. From 23 to 26 impressions for a print like "Yinaka genji," seems to us an excessive number. Even for a refined, although brilliant fruit piece, like "Nandina domestica," 33 printings impresses us as extraordinary, in spite of the fact that the use of flat blocks makes it necessary to multiply them so as to produce the desired gradations. With our means of producing gradations by either wood-engraving or lithographing, 8 to 10 printings would be considered a large number for the reproduction of an original of similar character. But even 33 is not the highest number of impressions used. I am informed by Prof. Fenollosa that as many as 120 impressions were used lately on a reproduction of a Japanese water-color painting, although the number was considerably reduced in the printing of a subsequent edition of the same picture by a different manipulation of the blocks.* It may be of interest to state here, for the sake of comparison, that the highest number of printings used on our most complicated chromolithographs is about fifty.

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[*] According to Dr. Brinckmann (p. 228), the inking of one block with several colors is occasionally carried so far as to produce a complete picture in several colors at one impression. Among other prints, he describes one of a gray grasshopper feeding on the reddish meat of a piece of watermelon, the green rind and the black seeds of which are also seen. The four colors named are applied, each separately, to different parts of the block. We have here the principle of rubbing in a plate in different colors, used so extensively by the printers of the colored stipples produced in the eighteenth century and now again popular. The principle has not, however, been applied to relief printing among us, except by Wm. Blake, and even by him only to a very limited extent.

From the statement by Mr. Tokuno concerning the pigments used in characteristically Japanese color-printing, *i. e.*, blue, yellow, and red, besides black and white, it would seem as if the whole system of this kind of printing were based upon the old three-color theory, which prevailed also with the early chromochalcographic and chromolithographic printers of Europe. It is nevertheless true that the Japanese printers do not, at present at least, produce the so-called secondary colors, green, orange, violet, by printing the so-called primaries, *i. e.*, blue and yellow for green, yellow and red for orange, and red and blue for violet, over one another. Wherever these "secondaries" are needed—and the same observation holds good also for the "tertiaries"—they are printed by themselves, although the "primaries" which enter into them may occur in the same picture. I am again indebted to Prof. Fenollosa for having called my attention to the fact that the printing of the "primaries" over one another to produce the "secondaries" does, indeed, occur in the earlier work of the Japanese printers, but it is evident that it has now been abandoned. As subdued and broken colors were mainly used in the earlier Japanese color-prints, while the modern show a decided preference for brilliant and even glaring coloring, it is quite likely that this printing of the "primaries" over one another, which with us is considered a decided advantage, more especially in cheaper and simpler grades of work, as it saves time and money, was given up, even in such work as the printing of pictures for fans, for the sake of the more brilliant effects which can be produced by mixing the pigments themselves.

This brings us to another point of great importance, and that is the little care had by the Japanese wood-cutters and printers for labor-saving devices and mechanical aids. "Our arts of engraving and printing," says Mr. Tokuno in one of his letters, "rely entirely upon experience, with no, or very slight mechanical assistance." The manual skill, which has grown out of this reliance upon experience and disdain for mechanical aids, is truly marvelous. It is difficult to believe that all Japanese wood-cutting, even to the finest lines in the most delicate black-and-white facsimile work, is done with the one clumsy knife represented in Fig. 1. We know from Papillon's book that he found it necessary to use three grades of knives, according to the grade of work to be executed, and we naturally arrive at the conclusion that the Japanese wood-cutter alsoac commodates his knife to his work. Nevertheless, Mr. Tokuno replies to a direct question on this point: "Our engraving on wood depends wholly on the skill of the engravers. With only one knife, such as that sent you, they can execute all grades of work, from the roughest to the finest. We therefore have no other kind of knife."

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*The earliest attempts at color-printing made by the Japanese, were, of course, much simpler, beginning with from two to four blocks. See Dr. Anderson's catalogue, before quoted, p. XVII; also Brinckmann.

The answers given to questions regarding the difficulties which confront the Japanese printer, and which to us would seem insurmountable, are of the same tenor. It seems impossible to prevent smearing, with blocks having great shallow hollows, inked with a brush, and therefore charged with color, not only on the parts left standing in relief, but also in the depressions, and with the thin moist paper used, held down on the plank with one hand, while the other guides the "baren." To the question whether any special precautions are adopted to prevent smearing, Mr. Tokuno replies: "Although smearing from the depressions in the block seems almost unavoidable, experienced printers, nevertheless, work without fear of it, and there is no special way of preventing it." Again, to the question whether mechanical means are not used for registering, the reply is: "Our printers use no mechanical means whatever, depending simply upon experience." To illustrate this point, a water-color drawing was sent, of which Plate XIII is a reproduction. To the inquiry, how it is possible to print with water-colors on moist paper, keep the paper moist to prevent contraction, and lay the sheets on top of one another without offsetting, the answer given is: "This can only be done well by an experienced printer," to which laconic statement a few technical points are added, which have already been given in Mr. Tokuno's communication.

A visitor to the U. S. National Museum, who sees, for the first time, and without explanation, the exhibit of Japanese wood-cutting and wood-cut printing, the whole (except the printed specimens and the drawings illustrating tools, etc.) crowded into a case measuring about 4 by 3½ by 2½ feet, will most probably take it for granted that he has before him a collection of miniature models. In this assumption he would, however, be grossly mistaken. Considerably more room would, of course, be needed to arrange the tools, etc., for practical working use, but both the tools and the materials shown are actually those employed by the wood-cutters and printers of Japan. It needs only to think of the heavy machinery used by our printers, even by those who confine themselves to taking proofs for wood-engravers, to realize the contrast between the methods of Japan and our own. Other occasions for comparing these methods have been brought out by the questions addressed to Mr. Tokuno, as given above, and the answers returned by him. The contrast becomes still more marked when we recall, for instance, the methods of preparing colors described by Mr. Tokuno. It is true, no doubt, that, influenced by us, the Japanese are coming to depend more and more on machinery, but it is also true that by their old and simple methods, trusting to their experience, their skill, and their artistic feeling, they have produced the best of their work, in which their national characteristics have found their most original expression. Nor have they, according to Mr. Tokuno's statements, suffered in productiveness in consequence of their methods. The short time spent in cutting the 37 planks needed for the printing of "Yinaka genji," *i. e.*, twenty days, is astonishing enough in spite of the simplicity of the blocks, but our astonishment increases to wonder when we read of the number of impressions made per day by the Japanese printers, and consider at the same time the tedious methods employed in charging the block with color. As I feared a misunderstanding on my part of the figures given by Mr. Tokuno, I asked him to consider my interpretation of his statements, and in reply the original figures were confirmed, viz., 3,000 sheets per day of about eight hours from the black block, and 700 to 800 sheets per day from the color blocks of "Yinaka genji," and on an average 943 sheets per day of "Nandina domestica," the number varying from 1,800 for the simplest to 600 for the most difficult blocks. It is impossible to make a direct comparison between the productivity of the Japanese and our own printers, as the methods differ too radically, and as long editions of wood-engravings are but very rarely printed nowadays on the hand-press. The following figures will nevertheless be of some interest: Mr. Thos. H. Brennan, wood-engraving proof-printer, of Boston, assures me that 250 impressions from a block measuring 11 by 14 inches and 350 from one measuring 5 by 7 inches is a fair average for a working day of nine hours. This is, of course, for first-class work and for first-class engraving. Messrs. L. Prang & Co., the well known chromolithographers, also of Boston, write me that the number of impressions which a lithographic printer prints on the hand-press, whether it be from a crayon stone or a pen-and-ink stone, in black or in colors, varies from 175 to 250 per day of nine hours, and that 200 would be considered a good average.

It goes without saying that the Japanese methods described above are not suitable for application to our art. A complicated sky, for instance, with all its wealth of delicate tints, such as we find it in the works of our best landscape painters, or the human countenance, expressive of the deepest emotions of the soul, as our best figure painters set it up before us, can be interpreted for us by the skill of our wood engravers, and even their coloring can be successfully approached by our color-printing processes in their most refined development, but they can never be rendered by means of flat blocks, even when painted in delicate gradations by the most skilled of Japanese printers, In try-ing to arrive at an estimate of Japanese color-printing, it must not be forgotten, therefore, that problems like those just alluded to are never offered to the Japanese reproductive artists. The originals which they are asked, not to interpret, but rather to imitate, or the original color-prints which they produce, are, indeed, exceedingly beautiful, and worthy of attentive study as giving embodiment to the ideals of a highly gifted people, moving in an intellectual atmosphere quite different from our own, but it remains true, nevertheless, that they are purely and frankly conventional. Looking at the technical side of the question only, it may be said that it is this fact which has enabled the Japanese wood-cutters and printers to find methods answering their wants almost to perfection. In a more searching study of Japanese art, other conditions would, indeed, also have to be considered, but their discussion would be out of place in a report like the present, which is of necessity limited to a statement of facts.

THE RELATION OF BIOLOGY TO GEOLOGICAL INVESTIGATION.

A SERIES OF ESSAYS DISCUSSING THE NATURE AND SCIENTIFIC USES
OF FOSSIL REMAINS AND THE NECESSITY FOR THEIR SYSTEMATIC COLLECTION AND PERMANENT CONSERVATION IN PUBLIC MUSEUMS.

By Charles A. White.

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PREFACE.

In the preparation of these essays I have had several objects in view, among which are a further presentation of elementary matter pertaining to biological geology than has before been published, the defense of biology as an indispensable aid in geological investigation and the repudiation of certain untenable claims that have been made in its favor, an application of the principles discussed to the practical work of the geologist, and the demonstration of the necessity of the preservation of fossil remains in public museums as storehouses of evidence upon geological questions. These essays are therefore confined mainly to a discussion of questions pertaining to biological geology, including both its structural and systematic branches, only incidental reference being made to other important branches of geological science, such as mineralogy, lithology, dynamic geology, etc.

I have intended an approximately full statement of the subjects selected for discussion as well as scientific accuracy in my conclusions, but in the manner of their presentation I have chosen to address general readers and students of geology as well as special investigators. I have accordingly presented a more detailed and methodical statement of the principal facts upon which biological geology is based than otherwise would have been thought desirable. Every working geologist is necessarily more or less familiar with the principles and criteria which are based upon these facts, but a comprehensive knowledge of them is not yet accessible to the student except by personal experience or didactic instruction; that is, because these principles and criteria have not yet been systematically and fully stated in published works the greater part of accessible knowledge concerning them is traditional.

It is true that some of the knowledge referred to has been briefly and more or less clearly presented in text-books, but the elements of biological geology are too comprehensive to allow of a satisfactory summary in even the largest of them. All discussions of principles and criteria pertaining to that subject are also usually omitted by authors of other works, evidently upon the reasonable ground that scientific writings ought not to be encumbered by a repetition of elementary principles, and upon the less reasonable assumption that the reader is familiar with and accepts as trustworthy those which they have adopted for their own guidance.

If it were not for my evident need of frequent reference to such elementary matter the desirability of publishing it in this connection might perhaps be questioned by those who are already familiar with it and with the range of its applicability. Still, the working geologist needs only to recall his early embarrassments and later experiences to be assured that the time has not yet passed when even the frequent enunciation of elementary truths is of material benefit to the student. I not only have not hesitated to adopt such a treatment of the subjects of these essays, but I have not sought to avoid numerous trite remarks and commonplace statements. These, however, are employed not so much for the purpose of conveying information as for that of giving logical continuity to the statement of my own ideas and of leaving the least possible room for doubt as to my meaning.

The relation of biology to geological investigation is so fundamental and the facts pertaining to it are so concrete and so accordant with both biological and physical laws, that the prevalence of any opposition to its legitimate claims seems unnatural. It is also unnatural that claims should still be made in favor of that relation which are not supported by the principles of modern biology. Of late years, however, such wide differences of opinion have become prominent, some of them being especially so among American geologists. In their writings some of these authors either entirely ignore biological evidence as furnished by fossil remains or treat the best of it as being of little importance in the investigation of structural geology. Others have taken quite opposite ground, not only making the just claim that biological evidence is indispensable in structural geology, but the untenable one that it is absolute and exclusive in systematic geology. Notwithstanding the prevalence of these extreme views, I have abstained from a controversial attitude in the treatment of the subjects to which they pertain, preferring to attempt their statement in such a way that the reader will necessarily reach correct conclusions.

Because it is necessary to discuss those differences of opinion in these essays, it is desirable to refer briefly to their origin and the causes of their perpetuation. Doubtless some of the causes of their existence are remote or obscure, but it is apparent that they are largely due to the broadening of the field of geological investigation, making it necessary that it should be divided into numerous specialties. In such cases it is natural that differences of opinion should be greatest between those investigators whose chosen studies are most diverse in character. Another cause is doubtless one of inheritance from the early condition of both geological and biological science.

A special cause of the perpetuation of these extreme views evidently exists in the form of personal domination by such of those who entertain them as happen to possess unusual opportunities for their enforcement. It is well known that such influence has at various times and in various ways retarded the progress of geological science and that there is danger of its being exercised in all cases when the personal judgment of an observer is liable to be modified or controlled by official or other temporary authority.

The opinions which have been referred to as the result of inherited errors are mainly those which relate to the application of biology to systematic geology. They are evidently due to the difference of ability or of inclination among the authors who have written upon those subjects, to adjust the early methods of thought which they have adopted to those which were made necessary by the great revolution in the views of naturalists upon the subject of evolution, which took place after standards for both biology and geology had been formulated and generally adopted. I regard this cause as being so important that I have arranged the discussions of the geological scale now in use so that they embrace references to the condition of thought among promoters of geological science from about 25 years before the revolution to the present time.

It is apparent, however, that, besides, the tendency to follow established channels of thought, which has just been referred to the continuance of these differences of opinion, and the consequent differences in practice among geologists, are largely due to the fact that the principles and criteria which are necessary to constitute a standard or series of standards which shall accord with modern views of biology have never been conventionally formulated and published. It is very desirable that concerted attempts toward such formulation should be made, but it is nevertheless true that the necessity for a special exercise of personal judgment in every act of geological investigation renders exact formulation peculiarly difficult.

The attempts toward enunciating principles and formulating criteria which are made in these essays have been suggested by those of my own geological investigations which have been prosecuted mainly from a biological standpoint. Among the incentives to these attempts has been a desire to give to the readers of my published writings upon the subjects referred to a more explicit statement of the grounds of certain opinions therein expressed than it was practicable to make in those writings. Indeed I believe the present general condition of geological science in all its departments demands from its active investigators some more definite public exposition of principles, and even of certain elements, than has yet been published. It is at least apparent that such publications for each subordinate branch of geology would be of great service to students because it would give them greater facility in comprehending the meaning of authors, and it would enable the latter to write more concisely and intelligibly, as well as more accurately, upon the results of their investigations. It would also give authors in the different branches of geology an opportunity to become better acquainted with the character and value of the work done by their colleagues.

The differences of opinion which have been referred to have necessarily produced corresponding differences in practice among geologists, and I have therefore found it necessary to consider them in connection with the application of the principles discussed in these essays to the practical work of the geologist. In doing so I have taken occasion to show that both extremes have had the effect not only to retard the progress of geological science, but to diminish the practical value of geological investigation. Furthermore, I have taken every opportunity to insist that notwithstanding the paramount value of fossil remains in structural and systematic geology the geologist, when investigating these subjects will be without excuse if he should fail to avail himself of every attainable relevant fact, whether biological or physical.

Finally, I have undertaken to point out some of the legitimate claims which geological science may make, not only upon individual investigators, but upon museums, and scientific organizations, and to show that these claims are based upon the necessities of science and not upon a sentimental idea.

I. THE CHARACTER AND ORIGIN OF FOSSIL REMAINS.

In prosecuting the study of the fossil remains of animals and plants, the investigator may have either one or the other of its two leading objects in view, but each being so closely related to the other it is always essential that they should be pursued with direct relation to each other. In the first case, the leading object to be attained is the extension of our knowledge of the animal and vegetable kingdoms far beyond that which may be acquired by the study of living animals and plants, and in the second case it is to apply that knowledge to the study of structural and systematic geology. The object in the first case is purely paleontological; in the second it is not only to acquire paleontological knowledge, but to apply it to various branches of geological investigation.

This essay, like the others which follow it, is written with immediate reference to the latter object, but the facts presented in it are of equal importance to the former. My principal purpose in writing it is the presentation of such facts as indicate the true significance and value of fossil remains in geological investigation that the references which are made in the following chapters may be the better understood. While I endeavor to point out clearly those facts which show the paramount value of fossil remains in geological investigation, I do not hesitate to also point out their imperfection as representatives of formerly existing faunas and floras as well as of separate members of the same. This candid treatment of the subject is not only proper in itself, but it is necessary in view of the fact that in the following essays I oppose certain views which are shown by geological literature to be held by many authors, especially those which indicate an underestimation of the value of all fossil remains on the one hand and the relative overestimation of the value of certain kinds on the other. A large part of this essay is of the most elementary character, but the necessity for having such elementary matter at hand for reference has already been pointed out, and it will further appear in the following essays.

The substance of the bodies of animals considered with reference to the subject of fossilization may conveniently be divided into soft and hard parts. The soft parts are those constituting the organs by which the physiological functions of the body are performed, together with their connecting tissues, while the hard parts are skeletal and protective in their character. Some animals are destitute of either skeletal or hard protective parts, and their bodies are therefore wholly soft or fleshy.

The soft parts of animals are always so soon and so completely decomposed after death that they are never really fossilized, but in rare cases the form of some of them has been preserved in fine sediments in the condition of imprints and molds.* Therefore in the study of fossil zoology we are, with the rare exceptions just indicated, confined to an investigation of the skeletal and protective parts of animals, because these parts alone are capable of true fossilization.

Those parts of the living animal are largely composed of mineral substances, and they are of various kinds and character, some being chitinous and some corneous, but the greater part are composed of lime compounds, the most common of which are bones and shells. They often are of different composition in different families or other divisions of the animal kingdom, and often thus different in different parts of the same animal. Being originally composed of mineral substances in intimate association with a small proportion of animal matter, and being usually still further mineralized by replacement of the animal by mineral matter in the process of fossilization, they become nearly or quite as indestructible as are inorganic minerals. It is, however, true that all kinds of hard parts of animals, even those originally containing the greatest proportion of mineral substance, if exposed continuously to the atmosphere after the death of the animal, will, within a few years at most, become as completely decomposed as will the soft parts. That is, the hard parts of animals may become permanently fossilized under favorable conditions, or they may become as completely decomposed under those that are unfavorable as will the soft parts under all conditions.

Compared with animals, the proportion of the component substance of plants, except that of a few kinds which quickly decompose after death, is very small. Much the greater proportion of the substance of all of them, aside from water, is carbonaceous and comparatively slow to decompose, but none of it resists decomposition so fully as does most of the skeletal and protective parts of animals. Still, the complete decomposition of all plants is certain unless they fall under conditions which are specially favorable to their preservation. Therefore in the study of fossil botany we are confined to an investigation of imprints, mostly of leaves, and of such of the woody parts as may have become antiseptically changed by saturation with certain acids or with soluble salts, or completely mineralized by a process to which I have applied the term histometabasis†. Immense quantities of vegetable substance have in past geological time been accumulated and reduced to the fixed condition of carbon and thus permanently preserved in the form of coal, but this substance has seldom been found of material use in the study of fossil botany.

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* See the close of this essay for an explanation of the different forms and conditions in which fossils are found and the different methods by which they have reached those conditions and acquired those forms.

† See remarks on conditions of fossilization at the close of this essay.

Because even the hardest and most enduring of the component substances of animals and plants become entirely decomposed if continuously exposed to the atmosphere after death, it is necessary to their permanent preservation that they should fall under such conditions as exclude the atmosphere. Almost the only way in which this can be accomplished in a natural manner is by their subaqueous intombment in the constantly accumulating sediments which are deposited at the bottom of all bodies of water. In the cases of aquatic animals such intombment of their remains is a necessary result of the nature of their habitat, but the remains of land animals and plants must reach such intombment accidentally if at all. The manner in which remains of land animals reach the waters, in the sediments of which they become intombed, is by accidentally falling into those waters and sinking there, or into tributary streams which transport them to the intombing sediments, their transportation being sometimes facilitated by buoyant gases which accumulate in recently dead bodies. Furthermore, the annual freshets which sweep the flood plains of rivers transport to such a sedimentary intombment remains of the various animals which at other times safely dwell there. Plant remains reach such intombment in similar ways, and also by the action of the winds. In the latter class of cases they are in the form of leaves and small fragments of the plants which grew in the vicinity of bodies of water. Besides the methods just mentioned remains of both animals and plants not unfrequently become intombed in the slime and flood accretions of marshes.

It will be shown on following pages that the difference in the conditions under which the various kinds of fossil remains have been preserved has much significance to the geologist, but it is proper to remark here that the more quiet the prevailing physical conditions and the less the necessity for the transportation of those remains to reach sedimentary intombment the more likely were they to become fossilized and preserved in a favorable condition for study. The conditions presented by an open seacoast were specially unfavorable because of the constant triturating action of the waves. It is doubtless mainly for this reason that so few remains of land animals and plants are found in marine deposits, notwithstanding the comparatively abundant opportunity that such remains must have had of being cast into marine waters.

It is of such aqueous sediments as have just been referred to that the stratified formations of the earth are composed, and it is such remains of animals and plants as have just been mentioned that constitute the fossils which are found to characterize them.

The statements which have just been made indicate that some kinds of the animals and plants which existed in former geological epochs could not have become represented by fossil remains in the sedimentary formations, because no part of their bodies was fossilizable. They also indicate that of those which might have become thus represented the representation of some of them is necessarily less complete than is that of others, because their fossilizable parts were less indestructible in some cases and the conditions necessary to their fossilization were less favorable in others. Furthermore, they show that while the preservation of the remains of some animals was a natural result of the conditions under which they lived, that of the remains of other animals and of plants was in all cases the result of accidental or unusual conditions.

The following brief review of the animal and vegetable kingdoms is presented for the purpose of further applying the general statements that have just been made to the subject of this essay and of comparing our presumably obtainable knowledge of extinct animal and vegetable forms with our more definite knowledge of those which now exist. The legitimate methods of this comparison have to some extent just been indicated and they will be further shown on subsequent pages. In the following remarks it will be necessary also to make some comparisons of the now living land and aquatic animals, respectively, with those which lived in past geological epochs.

If such a comparison could be made of all living with all extinct animals, the proportion of now living land animals would doubtless be shown to be much greater as a whole than it was during past geological time, because in the earlier geological periods there were probably no land animals in existence, and their proportional numbers have since gradually increased. In discussing certain of the higher classes, however, mammals and birds for example, I assume that the proportion of extinct aquatic to land denizens was not far from the same that it now is, because the latter animals lived only in later geological time, during which time their general conditions of life have probably suffered comparatively little essential change.

Vertebrata.—Excluding some of the lowest and also some doubtful or exceptional forms, all vertebrates possess either well developed teeth or a bony skeleton, and much the greater part of them possess both. Under favorable conditions the fossilization of these animal substances is complete. Therefore, having fallen under such conditions, almost any vertebrate animal which existed in former geological time is likely to have left fossil remains. The epidermal structures, such as horns, hoofs, feathers, etc., which cover either the whole or portions of the bodies of certain vertebrates, being more destructible than bones and teeth, are not often preserved in a fossil condition except as imprints or casts. This remark, however, does not apply to the scales of teleost fishes, which, although epidermal in their character, are nearly or quite as indestructible as are the bones and teeth of those animals.

Although the members of the orders Cetacea and Sirenia, and of the family Phocidæ* of the order Carnivora, are very numerous, they constitute only a small proportion of the whole class Mammalia, and it is these families alone every member of which is fully adapted to an aquatic life. A considerable number of other mammals, such as various carnivores, rodents, etc., are amphibious in their habits, but far the greater part of this important class are dwellers upon the land. Therefore, while remains of the extinct representatives of the aquatic animals just mentioned would naturally have become intombed in the sediments of the waters in which they lived, and have there become fossilized, remains of representatives of the strictly land mammals could have reached a similar intombment only in the indirect manner that has already been explained. That is, the intombment of the remains of the aquatic mammals was almost a matter of course, while that of the remains of all others was the result of the exceptional and accidental falling or conveyance of their bodies into the water after death, or of their miring and dying in the slime of ponds and marshes.

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*The small family to which the walruses belong should also be included here.

The greater part of the remarks which have just been made concerning mammals is applicable to birds, and perhaps in some respects with even greater force, for it is doubtful if so large a proportion of formerly existing birds as of mammals have become represented by fossil remains. Only a small proportion of now existing birds habitually live upon the water, and these, like all others, nest upon the land. The remains of at least a portion of those which habitually resort to the water are of course likely to become quickly intombed in its sediments, while remains of all strictly land birds must reach such intombment, if at all, by indirect or accidental means. Therefore, fossil remains of aquatic birds are more likely to be discovered in sedimentary rocks than are those of any others, although it is quite probable that the terrestrial kinds as greatly preponderated over aquatic kinds in former geological times as they now do.

While all reptiles are air-breathers many of them habitually live in the water and in adjoining swamps and marshes. Many of this class, however, are not only confined to the land, but some of them abound in arid districts. The preservation of reptilian remains is, of course, subject to conditions similar to those under which mammalian and avian remains are preserved, and it is therefore evident that while remains of aquatic and palustral reptiles may readily find sedimentary or slimy intombment those of strictly land reptiles are less likely to become thus preserved. It is doubtless in part for this reason that fossil remains of representatives of now living upland reptiles are so rare as compared with those of representatives of other living forms. It is true that a large proportion of the great extinct subclass of Dinosauria were vegetable feeders, as is shown by their skeletal structure and especially by the character of their teeth, but most of those whose remains have been discovered were probably of lowland or palustral rather than of upland habitat. Their remains were therefore more likely to have undergone intombment than were those of the upland reptiles which may have been contemporary with them. That is, besides the usual methods in the case of land animals, their remains were liable to intombment by miring in the slime of marshes and shallow waters or by receiving a covering of such sediments as river floods usually carry.

A few of the living Batrachia pass their whole lives in the water, but the greater proportion of them are, in their adult state, air-breathing palustral animals. A smaller proportion of them live upon dry land, but these, like all the others, have aqueous respiration during their larval condition. Besides this, as a rule, those which are strictly land animals in their adult state seek the water at the breeding season. Therefore, a larger proportion of batrachian remains are likely to find palustral, than other sedimentary, intombment. The living Batrachia do not constitute so conspicuous a class as do the other vertebrates, and fossil batrachian remains are also comparatively rare, but among the reasons for this rarity is doubtless the fact that few of the class inhabit the larger bodies of water, such as those in which the more important formations were deposited.

Because all fishes are of aquatic habitat the intombment of their remains in the sediments of the waters in which they lived is more a matter of course than it is in the case of any of the other vertebrates. It is true, however, that fossil fish remains are, as a rule, less abundant in the sedimentary formations than might be expected in view of the comparative abundance of fishes in now existing waters. This is difficult to explain, even if it were now necessary to do so, but it is perhaps due in part to the entire destruction of their bodies in many cases by predatory enemies, in part to the large proportion of animal matter in their bones, and in part to other destructive causes acting upon the usually but not always fragile ichthyic skeleton. The absence of a true skeleton in many fishes ought also to be taken into consideration in this connection, extinct fishes of this kind being represented only, or mainly, by teeth and spines.

Mollusca.—The hard parts of mollusks, those which are preservable by sedimentary intombment, consist mainly of lime carbonate with a smaller proportion of animal matter than the hard parts of vertebrates contain. They are sometimes internal; but these, strictly speaking, are not skeletal in the sense that the bones of vertebrates are so. Usually they form a protective shell which envelopes the whole, or the greater part, of the animal. Much the greater proportion of the members of this branch of the animal kingdom have aqueous respiration, and these consequently live only in the water. The others are air-breathers and live either upon the land or at the water's edge. Many species and genera and some whole families of both aquatic and land mollusks have no hard parts, and their bodies are therefore immediately and completely decomposed after death, leaving no trace of their former existence. The hard parts of aquatic mollusks find speedy intombment in the sediments at the bottom of the waters in which they lived, while those of land mollusks are liable to complete atmospheric decomposition, or if thus intombed they must reach those sediments in the accidental manner which has been described on preceding pages.

It is reasonable to assume that at least as great a proportion of extinct, as of living mollusks were destitute of protective shells, and that as great a proportion were provided with only internal or other imperfect shelly parts. This having been the case it is plain that a large part of formerly existing mollusks can have no representation among fossil remains, and that a large proportion of the others must have failed of such representation. Still, mollusks as a class are so generally provided with a complete shelly protection for their bodies that these objects are among the most abundant and valuable fossil remains of which the geologist makes use in his investigations. Their value is enhanced above that of the remains of any other class as a whole by the fact that so large proportion of them were denizens of the waters in which were deposited the sedimentary formations which are now characterized by them.

Annuloida.—The existence in former geological time of others of the Annuloida than those which constitute the class Echinodermata has never been satisfactorily proved by the discovery of their fossil remains, but there seems to be no reason for doubt that some such animals really existed during at least a portion of that time. If such were the case their failure to be represented by fossil remains was doubtless due to the absence or imperfection of hard or fossilizable portions of their bodies. On the contrary, only a few of all the living Echinodermata are destitute of protective hard parts, which generally consist of a nearly or quite complete calcareous spinous test that under favorable conditions preserves the form of the animal after death. Most of them are provided with certain small internal hard parts, but no true skeletal frame.

The abundance of discovered fossil remains of Echinodermata show that the plan of their anatomical structure was essentially the same as that of their living representatives. The living Echinodermata are dwellers in marine waters, and it is presumable that the class has always been confined to a marine habitat. In former geological ages their representatives were abundant and varied, as is shown by their often abundant calcareous remains which are found in many formations, where they readily became intombed when those formations were in the condition of sediments in the waters in which those Echinodermata lived.

Annulosa.—Of the five classes constituting the Annulosa remains of the Crustacea are more likely than those of the others to be preserved by sedimentary intombment, because all the members of this class are provided with a more or less firm chitinous or calcareous covering for their bodies, and because with few and comparatively inconspicuous exceptions they are all of aqueous respiration and aquatic habitat. Being of aquatic habitat the Crustacea of former geological periods are likely to have become quite completely represented by fossil remains, because their crustaceous coverings would have found ready intombment in the sediments of the waters in which they lived. It is nevertheless true that while crustacean remains are by no means rare in paleozoic strata, in mesozoic and later formations remains of this class have rarely or never been found abundant, and often they do not appear among fossil faunas, the members of which would seem to have been their natural associates. This is all the more noteworthy because of the frequent molting of the mature shell by these animals, each individual of which would thus produce many fossilizable counterparts of itself.

The Myriapoda, Arachnida, and Insecta are so generally dwellers upon the land, that, as a rule, their remains can reach sedimentary intombment only by such accidental means as have been mentioned in preceding paragraphs when referring to other land animals. The preservation of such remains of these Annulosa, however, as may undergo sedimentary intombment is favored by the fact that they are generally provided with a covering of chitine, a substance which resists decomposition more effectually than do most other hard parts of animals, not excepting bones, teeth, and calcareous shells.

These three classes, especially the Insecta, are now represented by myriads of mostly minute animals presenting the greatest diversity of form and of habits of life. It cannot be doubted that at least the Insecta were abundantly represented among the faunas of former geological periods, although fossil remains of them are comparatively rare. This rarity is doubtless due to the fact already indicated that their remains could have reached sedimentary intombment only by accidental means, and also in part to the fragile character of the chitinous covering of a large proportion of them. In short, it seems necessary to conclude that comparatively little can ever be known concerning the probably great abundance of Insect, Arachnid, and Myriapodal life of former geological time.

Only the aquatic Annelida need be considered in this connection, because no satisfactory remains of extinct representatives of the others are likely to be found among any of the fossil faunas. Even the aquatic Annelida are of less importance as regards the subject of this essay than are most of the other classes of animals, because, with the exception of the Tubicola, few of them possess such hard parts as instructively represent their different forms after the death of the animal. It is true that some of these are provided with a more or less delicate chitinous covering which sometimes approximately preserves the form of the animal after the decomposition of the soft parts, and some of them also possess minute teeth. Traces of forms similar to these are sometimes discovered in stratified rocks, as are also such minute teeth as compare with those of some living annelids.

The living Tubicola, however, secrete an external shell, usually calcareous and much like that of the Gasteropoda, and such shells as these in considerable variety are found among fossil faunas. Many aquatic annelids burrow in the mud or sand at the bottom of the water in which they live, and similar burrows are not unfrequently found in sedimentary strata, which were doubtless made by extinct annelid species.

Cœlenterata.—The Cœlenterata consist of somewhat numerous orders and families, all of which are aquatic animals and all except a few inconspicuous forms are denizens of saline waters. Therefore if all the living members of this branch of the animal kingdom were possessed of such hard parts as would resist decomposition after death, we would be justified not only in inferring that the bodies of their extinct representatives were similar in structure, but in assuming that all of them have been more or less completely represented by fossil remains. A large part of the living Cœlenterata, however, are entirely destitute of even the most delicate hard parts, while others secrete a more or less massive calcareous or corneous skeleton, or sometimes an external tube, such as the well-known corals, sea fans, etc. It is therefore necessary to infer that while a very large proportion of the Cœlenterata which have existed during past geological time secreted coralline skeletons and tubes in infinite variety, another large proportion have left no material proof of their existence. It is true that casts and impressions in fine sedimentary strata of certain extinct forms of jelly fishes have been discovered;* but this is a rare and remarkable exception to the rule just referred to, the purport of which is that none of the extinct animals whose bodies consisted only of soft parts could have left any satisfactory evidence of their existence. Fossil corals are often so well preserved that they may be as completely studied as the now living forms, but still much of the structure of the extinct polyps must forever remain unknown.

Protozoa.—All the Protozoa to which reference need be made in this connection are of aquatic habitat, most of them living in marine waters. These are the Foraminifera, Radiolaria, and Spongida, and only these secrete such hard parts as resist decomposition. Their hard parts are sometimes in the form of minute complex calcareous or siliceous shells, sometimes of calcareous or siliceous masses, and they sometimes consist of the well-known substance which constitutes sponges.

Much of protozoan life has no known connection with such hard parts as have just been mentioned, and it is presumable that the proportion of protozoan forms which secrete no hard parts was similar in past geological epochs to that which now obtains. If so, there must have been an abundant representation of such life in the past of which no trace has been left.

Plants.—The natural method by which plants or portions of them may be preserved from decay, and the conditions that during the geoogical epochs have been necessary to their fossilization, have already been referred to, but it is desirable to consider to what extent remains of extinct floras may have been so preserved and fossilized.

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* See remarks on conditions of fossilization at the end of this essay.

The true aquatic plants or algæ, except those belonging to the family Corallinaceæ, are usually so succulent that they decompose almost as quickly as do the soft parts of animals, and they are therefore represented in sediments only as casts or impressions. Although the diatoms are represented by abundant remains in both marine and nonmarine waters, comparatively little use has been made of them in the systematic study of fossil remains.

With few and comparatively unimportant exceptions it is only such plants as grow upon marshes which are subject to periodical overflow and sedimentary accretion, and such portions of others as may be cast into adjacent waters by the winds or carried into them by river freshets, that are likely to undergo such sedimentary intombment as would insure their preservation in a condition for satisfactory study. No upland plants, except portions of those which grow in the neighborhood of bodies of water, are likely to become so intombed, and herbaceous plants, most of which wither and remain attached to their roots, as well as the foliage of evergreen trees, are also not likely to be cast into the water together with autumn leaves of deciduous trees. Again, the fruits of deciduous trees, being usually more compact than their leaves, are not likely to be transported by winds to a sedimentary burial.

It is therefore apparent that the representation by fossil remains of every formerly existing flora is necessarily very incomplete, not only because of the accidental character of even the most favorable conditions for their preservation, but because a large, and apparently the larger, part of every flora existed under conditions which rendered the preservation of any portions of it impossible. Furthermore, the process of intombment, as well as of being detached and conveyed to it, necessarily reduced every plant so preserved to a fragmentary condition, and breaking up the rocks in which they are now found they are unavoidably still further injured and often destroyed by even the most careful collector.

The incompleteness of representation of extinct animals and plants by fossil remains when they are considered with reference to the entire bodies of living animals and plants has already been referred to. It has also been shown that a large proportion of the animals which lived in the various geological epochs could have left no recognizable trace of their existence because of the perishable nature of all parts of their bodies. From these and other facts which have been stated the conclusion is necessary that a very large proportion of those extinct animals and plants which possessed fossilizable parts have never been represented by fossil remains, because those parts, not having fallen under conditions favorable to their preservation, have been as completely decomposed and destroyed as have the soft parts of the same bodies.

Besides the facts already indicated the following have special significance in this connection. All fossil remains are more or less imperfect as such because of the destructive natural conditions to which they inevitably have been subjected, and the firm consolidation of most of the rocks containing them has rendered impossible the recovery of the greater part of those which have really been preserved. The successive displacements which have taken place in the crust of the earth have so exposed the sedimentary formations to erosion that during the successive epochs large portions of all of them have been destroyed, together with their fossil contents, thus reducing the paleontological record to that extent. Other large portions of those formations have been so completely covered by succeeding deposits, by debris resulting from their erosion, and by the waters of present lakes and seas that they are inaccessible for study, and the available paleontological record has been thereby still further reduced.

An additional reduction has doubtless been accomplished by metamorphism—that is, in view of many important facts, both physical and biological, it is not unreasonable to conclude that the various series of pre-Cambrian stratified formations which are found in different parts of the world were once fossiliferous, and that the fossils they then contained have been destroyed as such by the metamorphic action which changed the mineral character of the strata.

If fossils were to be treated only as mere tokens of the respective formations in which they are found, their biological classification would be a matter of little consequence, but their broad significance in historical geology as well as in systematic biology renders it necessary that they should be classified as nearly as possible in the same manner that living animals and plants are classified. Considering the imperfection of all fossil remains, the question arises, Can they be classified upon the same general plans and by the same systematic methods that are used for living animals and plants? The answer is mainly in the affirmative, because structural characteristics are possessed by the fossilizable parts of animals and plants which are cognate, coincident, and of a similar classificatory character with those of the unfossilizable parts, although the latter, being more complete and convenient, are mainly relied upon in the classification of living forms.

As regards the classification of animal fossil remains, precisely the same system is available that is used for living animals, the former classification being in fact only an extension of the latter. In the former case, however, the methods and details depend more fully than in the latter upon the well established principles of comparative anatomy, because the direct and complete anatomical study of fossil animals is for obvious reasons impracticable. Indeed, it is upon comparative anatomy that most of the real scientific value of fossils depends, and without its aid they would always remain little more than mere curiosities or arbitrary tokens of the formations, in which they are found. With the aid of comparative anatomy and systematic taxonomy these fossils, notwithstanding their imperfection and faunal incompleteness, become not only indispensable in geological investigations, but real representatives of the grand succession of animal life that has existed upon the earth.

In the case of fossil Vertebrata it is the skeleton and teeth almost alone that are used in classification, but so distinctly were the classificatory characteristics of those animals impressed upon the hard parts of their bodies that the nearly or quite complete structure of the whole animal may legitimately be inferred from them. Furthermore, these characteristics are so distinctly impressed upon the teeth and upon certain essential parts of the skeleton that legitimate classification of extinct forms can often be established upon no more than a few scattered teeth or fragmentary portions of the skeleton.

The extinct Mollusca, as has already been shown, are represented by their fossil shells, and these are classified precisely as are the shells of living members of that class.* Moreover, the classification of the fossil molluscan forms accords more completely with that of the living than is the case with the Vertebrata because living mollusks are largely classified by their shells alone, even when the soft parts of the animal are available.

As in the case of the Mollusca the fossil Echinodermata are classified in the same manner and by the same means as are the living forms, because the classification of the latter is based mainly upon those which in the extinct forms become fossilized.

The method of classification of all the fossil Annulosa is essentially the same as that which is used for the living forms, the difference, if any, being mainly due to the usual incompleteness of the fossil specimens. In such cases, as well as in those of the greater part of other fossil remains, more attention is given to certain characteristics of the hard parts than is found necessary when the whole animal is available for study.

While the classification of those living Cœlenterata which have no hard parts is necessarily based wholly upon the structure of their soft bodies, that of those living forms which possess skeletal or protective parts is largely based upon them. In this latter respect the extinct Cœlenterata are classified in the same manner as are their living representatives, namely, by means of their coralline hard parts.

Because the soft bodies of the living Protozoa are so nearly structureless that they can not furnish a satisfactory basis for classification it is necessarily based upon the structure and character of the hard parts in the case of those which secrete them. Therefore the classification of the fossil Protozoa has precisely the same basis as has that of the living forms.

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* The elaborate classification of the fossil cephalopods by means of their septal flexures may be taken as an exception to this statement.

The classification of fossil plants is, in a general way, similar to that of living plants, and so far as the recognition of the great classes and subclasses is concerned it is the same—that is, each of these higher divisions of the vegetable kingdom is recognizable among fossil-plant remains by its peculiar histological structure and the characteristic plan of its foliage venation; but the method of discrimination of species and genera of fossil plants is wholly different from that which is employed in the study of living plants, the latter method being impracticable because of the imperfection of the fossil material. In the case of living plants the detailed structure of the flower and fruit together with the general structure of the whole plant forms the basis of classification. In the case of fossil plants, however, classification is based almost wholly upon foliage, the main reliance for the discrimination of species being upon the venation of leaves the imprints of which are found upon the riven surfaces of stratified rocks, while their form or marginal outline is the principal reliance for the discrimination of genera. Other data are sometimes used for classification, such as the general form of the plant so far as it may be determinable, the microscopic woody structure, etc.; but these are rarely available and are generally less satisfactory than are those which are furnished by foliage.

In presenting the foregoing statements concerning the character of fossil remains I have taken occasion to indicate their high biological value not only when considered as fossils, but even in comparison with living forms as a standard, especially when studies and comparisons of them are made with reference to the principles of comparative anatomy; and I have also asserted their paramount value in geological investigations. Still, I have not hesitated to call attention to their imperfection and their faunal and floral incompleteness—that is, I have thought it necessary to indicate how incompletely any of the faunas and floras which have formerly existed upon the earth are, or can be, represented by them, and also how imperfect, even as fossils, are a majority of the specimens which reach the geologist's hands. My object in doing this is to show that the boundaries of possible knowledge with reference to the life which has formerly existed upon the earth lie within the limit which some authors have seemed disposed to assign to it, and in the same connection I have called attention to certain other facts whch indicate that at least portions of the knowledge which is legitimately attainable may be overestimated or misapplied.

This treatment of the subject would be unfair if it were not accompanied by statements of facts and principles showing the paramount importance of fossil remains in the prosecution of geological investigation. Such a showing will be made in the following essays, and in the same connection the true value and teaching of fossils will also be discussed.

The following explanation of the different conditions in which fossil remains are found will supplement the preceding discussions and add to the description of their character which has already been given.

There are seven different natural conditions in which fossil remains are recognizable, three of which relate to substance, three to form, and one to both. To those relating to substance I have applied the terms permineralization, histometabasis, and carbonization; to those relating to form, the terms molds, imprints, and casts; and to the one relating to both form and substance, the term pseudomorphism.

The term permineralization applies to that condition of fossil remains of animals which differs least from their original condition as parts of living animals, such, for example, as bones of vertebrates, shells of mollusks, tests of crustaceans, etc. It is in this condition that the greater part of all fossil remains are found. In their original condition they were all composed of both mineral and animal matter. Mineral matter greatly preponderated in all of them, but the proportions differed much in the case of different branches of the animal kingdom. For example, the proportion of animal matter is much greater in bones, even in their most solid portions, than in shells of mollusks or tests of most crustaceans. In all cases, however, the proportion of mineral matter was sufficient to perfectly preserve the original form of each specimen during the process of fossilization. Their only material change in this process was the removal by decomposition of the animal matter and its replacement by mineral matter, the latter having been added as a precipitate from its solution in the waters in which the fossilization took place. This having been continued until all the minute interstices originally occupied by the animal matter were filled, the fossils became wholly mineralized and as indestructible as are other minerals of like composition. Indestructibility of these fully mineralized fossils, however, is not in all cases absolute, as will appear by remarks in following paragraphs.

The term histometabasis* is applied to that condition of fossilization in which an entire exchange of the original substance for another has occurred in such a manner as to retain or reproduce the minute and even the microscopic texture of the original. It is especially applicable to silicified wood. In such cases of fossilization the exchange has been made by destructive decomposition, molecule by molecule, of the woody tissues and their immediate replacement by precipitated molecules of the silex held in solution in the water in which the wood was immersed. By this remarkable process not only the original cell structure of various kinds of wood but the characteristic cell markings of each kind are often found to have been so perfectly preserved in the solid agate-like mass that it may be as completely studied as if the specimens were taken from living trees.

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* Etym.: ἱστός, tissue; μετάβασις, exchange.

Pseudomorphism of fossils is so nearly like that of mineral crystals that this term is equally applicable to both. It consists in the replacement of the original substance of the fossil by a crystallizable or crystallized mineral, such, for example, as calcite, pyrite, quartz in the form of chalcedony, etc., the original form of the fossil being perfectly retained. It is evident that at least a part of the crystallized pseudomorphs were formed by the precipitation of the component mineral from its solution within such cavities as are described as molds in another paragraph. In such cases they differ from casts as described on the next page only in being crystallized, but crystallization is one of the distinguishing characteristics of pseudomorphs. In many cases pseudomorphs were evidently formed by molecular replacement. All those chalcedonic pseudomorphs of shells which sometimes occur in limestone, and from which they often may be freed in a complete condition by acids, have doubtless been produced by molecular replacement.

The term carbonization is applied in this connection only or mainly to such masses of vegetal remains as coal, lignite, and peat. While such remains are of great economic value and often of great importance in structural geology, they are of little paleontological importance, because the organic structure of the plants from which they were derived has been so completely obliterated as to render them useless for such a purpose. Occasionally, however, fruits and other separate parts of plants are found to have acquired a carbonized condition in which their botanical character may be approximately determined.

Molds are cavities in sedimentary rocks which were originally occupied by fossils, the latter having been subsequently removed by the percolation of water containing a solvent of the fossils but not of the rock. Such solvents, while completely removing certain kinds of fossils sometimes left others unaffected, and sometimes they acted unequally upon fossils of essentially the same chemical composition. For example, the shells of the Ostreidæ almost always have resisted such solvents more than have most other shells. The original surface features and markings of fossils are often minutely preserved in molds, but they are frequently obscured in different ways; for example, by compression of the mold after it was formed, or by its having received a drusy lining.

Imprints do not differ materially in character from molds, the former term being usually applied to impressions left in the rock by thin substances like leaves of plants, wings of insects, etc., after their removal by decomposition. Sometimes, however, the molds of shells and other fossils have been reduced to the character of imprints by the extreme pressure to which the strata containing them have been subjected. The details of imprints have often been obscured by pressure, as in the case of molds, but they are often preserved with the greatest degree of minuteness.

Casts are counterparts of fossils, having been produced by the filling of molds with a substance other than that of the original fossil. It may have been by the injection, caused by pressure or otherwise, of substance derived from the matrix or inclosing rock, or by the precipitation of substances brought into the cavity suspended in percolating water. If in the latter case the cast is composed of a crystallized mineral, the term pseudomorph is applied to it, as already stated. Natural stony casts of the interior of shells and other fossils are often found within the molds which were formed by the solution and removal of the fossil itself, and they are also often found filling permineralized shells. The student of fossils often finds it desirable to take artificial casts of natural molds, especially in case he can obtain no other representation of the species he desires to study. By such a cast the original form and surface features are often reproduced with the greatest accuracy.

In the foregoing paragraphs are described the principal conditions in which fossils occur or by which they are represented, but one occasionally finds specimens which indicate certain conditions that are not fully recognized in the foregoing descriptions.

These cases, however, are less important than are those which have been considered, and they need not be further mentioned, but it is desirable to refer to certain conditions under which the soft parts of animals have sometimes been represented by impressions in sedimentary rocks, or under which they have been preserved from ordinary decay for an unusual length of time.

The fact was referred to on page 252, that although the soft parts of animals could never have become really fossilized, cases have occurred of the preservation in fine sediments of their form and even parts of their structure, in the condition of imprints or casts. A most remarkable and exceptional case of this kind is that of the jelly-fishes of the Jurassic slates of Solenhofen, where, in the fine sediments of which the slates were originally composed, not only their shape but the essential parts of their structure are preserved. Impressions, presumably of similar animals, have been found in older rocks, but these are less perfect than the Solenhofen specimens.

Fossilization or petrefaction of human bodies is often popularly reported to have occurred, but these are only cases of the change of the adipose and muscular tissues of the body to the wax-like substance adipocere, which process only delays but does not prevent final and complete decomposition. This change frequently occurs in other animal bodies that have become buried in wet or constantly damp earth, and packages of pork recovered from old river wrecks have often been found to have undergone the same change.

Every specimen of fossilized man is really only a skeleton, but the wonderful cases of preservation of the human form in the partially hardened volcanic ash of Pompeii are worthy of mention in this connection as illustrating more than one of the facts that have been stated in the foregoing paragraphs. While excavating the buried city the workmen came upon molds of the bodies of persons who were suffocated by, and buried beneath, the shower of ashes from Vesuvius. The body, even including the bones, long ago decomposed and was removed by the percolation of water which fell from the clouds. Casts of these molds, when discovered, were made by pouring them full of plaster, and when the comparatively soft inclosing matrix was removed an exact counterpart of the body was disclosed just as it fell in death well nigh two thousand years ago.

II. SEDIMENTARY FORMATIONS, THEIR CHARACTER AND LIMITATION.

It is apparent from statements made in the preceding essay that, as a rule, to which there are no geologically important exceptions, fossils have been preserved only in those accumulations of aqueous sediments which are now known as the sedimentary or stratified rocks of the earth, and that it is therefore these rocks only which furnish biological data for geological investigation. Furthermore, it is upon the general classification of these rocks, based upon both their physical and biological characteristics, that the whole system of historical geology depends, and it is their fossil contents that furnish the most efficient aid in the study of structural geology. The following essay will be devoted to discussions of these subjects, and it is therefore desirable first to present some remarks upon the stratified rocks with reference to the origin and limitation of the formations into which they are naturally divided. These remarks will necessarily include both the physical and paleontological definition of formations, and a reference to their use as units of stratigraphic classification.

There has been much difference of custom among geologists as regards the use of the term formation, some applying it to the smallest assemblages of strata which possess common characteristics, while others designate by the same term those series of formations to which the term system has been generally applied. That is, some apply the term formation to local or limited developments of strata, while others apply it to such systems as the Devonian, Carboniferous, Cretaceous, etc. This term has generally been confined to the stratified rocks, but by a few authors it has been applied to the eruptive, and also to the great crystalline rock masses. In these essays, however, the use of the term formation is not only confined to the stratified rocks, but it is restricted to those assemblages of strata which have common distinguishing characteristics, whether they have little or great geographical extent, or whether they aggregate a few feet or thousands of feet in thickness. That is, the use of the term is herein confined to those assemblages of stratified rocks of sedimentary origin* to which many authors have applied the term group, and others the term terraine.

A formation of this kind consists of an assemblage of strata which bears evidence of having been deposited by continuous sedimentation in a broad body of water, the sediments in different formations and sometimes in different parts of the same formation having varied in condition from that of impalpable fineness to that of sand and gravel. They are composed of calcareous, argillaceous, or siliceous materials which in process of time have become more or less completely hardened into rock and which in their separate condition are limestones, sandstones, and shales, respectively. These materials may, and often do, occur thus separately, not only in different formations, but in different parts of the same formation. Besides this, the different materials are often mechanically commingled, producing rocks of a mixed character; and sometimes the character of all kinds of stratified rocks is found to have been materially changed by metamorphism.

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* To avoid frequent repetition, the terms sedimentary formation and stratified formation are used interchangeably when applied to formations as defined in this essay. The terms sedimentary rocks, stratified rocks, and fossiliferous rocks are also used interchangeably, but with a somewhat more general meaning than is intended by the two former terms.

Formations differ greatly in thickness because the rate of accumulation of sediments was necessarily very variable and because their upper and lower limitation was coincident with, and due to, accidental changes of physical conditions which occurred at irregular intervals of time. That is, their limitation was caused by such movements of the earth's crust, including both land and sea bottom, as produced a more or less complete interruption of sedimentation, or change in the character of the same, and consequently a more or less complete extinction, or geographical transference, of the life that existed in the water in which the sediments were deposited. This is an almost invariable rule, but in rare cases the faunal and physical delimitations were not fully coincident. In such cases an abrupt faunal change has occurred within the vertical range, or at the upper limit, of a formation where sedimentation seems to have been unbroken between it and the next succeeding one. Such cases plainly resulted from a change in the character of the water as a faunal habitat, which was not accompanied by a corresponding arrest of, or even by a material change in, the character of the sedimentation.*

Formations may sometimes be continuously traced by the eye for considerable distances, especially if the débris of erosion has been well removed by denudation. In such cases no question can be raised as to their identity. Sometimes also a formation may be satisfactorily recognized at separate but not distant localities by means of its lithological characteristics alone when actual continuity is obscured or hidden from view by succeeding formations or other overlying material. In their greater geographical extension, however, formations undergo such changes of lithological character, and they often so closely simulate some one or more associated formations, that their lithological identification is uncertain or impracticable. Therefore, with the minor exceptions mentioned, the only known means by which a formation may be certainly identified at any other than its originally discovered locality is that which is afforded by its contained fossil remains.

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*Reference is here made particularly to conditions that are observable among the Upper Cretaceous formations of the interior portion of North America.

Because of the frequent displacements of portions of the earth crust which have occurred during geological time, and also because of the resulting great erosion of the materials of which formations are composed, none of them now exists in its original entirety, but it is desirable to consider them with reference to their origin as well as to their present condition, the better to understand their character.

Every formation originally consisted of sediments, which, within a portion of geological time of limited but uncertain duration, were deposited in any broad body of water, whether inland or marine, during all of which time both the body of water and the surrounding or adjacent land remained comparatively unaffected by displacements of the earth's crust or by any other adverse physical changes. Under favorable conditions every such body of water was the congenial habitat of aquatic animals, remains of which became fossilized in the constantly accumulating sediments. These animals constituted more or less distinct faunas, the geographical range of each of which was, in the case of inland waters, throughout the whole area occupied by each, and in the case of oceanic waters, throughout each of such large portions as were circumscribed by natural intramarine limits to faunal distribution, these limits having been in a general way barriers between faunal areas, although they were never sharply defined and were usually indefinite.

Within these more or less indefinite intramarine barriers the various forms of aquatic life constituted a separately recognizable fauna, and the sedimentary deposits became a separately recognizable formation. Still, those barriers are properly designated as indefinite because it is evident that the sedimentary deposits of any one of those ancient oceanic areas always blended to a greater or less degree with those of adjacent areas, and that certain members of every fauna ranged into adjacent faunal areas, just as certain species of every living marine fauna have a much wider geographical range than have most of their associates.

Much the greater part of the sedimentary formations of the earth were deposited in marine waters, as is shown by the character of their contained fossils, and most of those waters were then, as now, of oceanic extent. The character of the contained fossils of a comparatively small but important part of the sedimentary formations, however, show that they were deposited in inland bodies of water, some of which were fresh and some brackish. Some of those inland bodies of water were comparatively small, but others were of such extent that their deposits rival marine formations in that respect.

Every formation resulting from deposits in inland waters having had practically the same geographical extent as the body of water in which it was deposited, the original boundary of the whole formation was coincident with the shore line, but this can not be assumed with regard to the formations which were deposited in waters of oceanic extent. These, like existing marine waters, notwithstanding their extensive continental and island shore lines, which became in part original limits to formations, had world-wide continuity, but it is evident to every geologist that the most extensive of the marine formations in their separate physical and biological identity have rarely exceeded a few hundred miles in extent, and they are often much less. The variable physical limits to the areas of sedimentation within which were produced the separately recognizable formations were coincident with the indefinite intra-marine faunal barriers just mentioned, and all marine formations more or less completely merged both their physical and faunal identity into that of those which were deposited in adjacent waters. It is to be inferred that climatic influences, or rather those of temperature, had much to do with faunal limitation, but temperature was doubtless in large part equalized by the currents which conveyed the sediments that produced the formations.

The geographical definition of marine sedimentary and faunal areas, and consequently that of the resulting formations, was mainly or wholly due to the various and shifting conditions of land and sea bottom, which in different parts of the world and during successive geological epochs modified or changed the distribution of sediments within the great areas into which the oceanic waters were thus divided, and it was generally accomplished without affecting the aqueous continuity between them. In a large proportion of cases these shifting conditions did not affect the continuity of those waters, and they were sometimes so slight as to leave the resulting formation with illy defined upper and lower limitations, as well as with their usual indefinite geographical boundaries. They were often so great, however, as to elevate and long retain the former ocean bottom above the water level, and to thus produce a greater or less unconformity of, or a longer or shorter time hiatus between formations.

While shifting conditions of sea bottom constituted the principal factor in limiting areas of sedimentation, they sometimes caused the partial overlapping of the borders of contemporary formations by having alternately shifted those of adjacent sedimentary areas, thus adding to the usual indefiniteness of such boundaries.

The upper and lower limits of formations were sometimes produced by the elevation of sea bottom above water level and its resubmergence, in which case those limits were sharply defined. In other cases the movements of elevation and depression were too slight to entirely interrupt sedimentation, and those or other physical changes were too slight to prevent the survival of certain members of the earlier fauna as members of the later one. Indeed, it is through such survivals that continuity of life has been preserved during the whole range of geological time. In such cases the physical difference between the formations is usually slight. This, added to the partial commingling of their faunas, sometimes renders it difficult to fix upon a dividing line between them, and makes it especially necessary in determining the characteristics of each formation to study their respective faunas each as a whole. Still, it is usually the case that the vertical range of a large proportion of the species is not found to pass beyond the vertical limits of the formation in which they occur.

The beginning and ending of the sedimentation which produced each formation having been dependent upon the unstable conditions of the earth's crust, the occurrence of the displacements of which were irregular in time and variable in extent, formations are necessarily not only very unequal as regards their geographical extension, but also as regards their relative value in stratigraphical classification. For these, among other causes, they are also unequal in their relative importance as representing stages in biological development.

The foregoing remarks apply especially to marine formations, and they are of general applicability. The manner, however, in which occurred the upper and lower delimitation of the series of fresh water formations in the interior region of North America was evidently somewhat exceptional. These deposits took place in waters which rested above ocean level, and their differentiation into formations was evidently largely due to the shifting level of the waters in which they were respectively laid down, as well as to the shifting of the areas of denudation from which their sediments were derived. The latter was doubtless also the cause of the differences in lithological charactistics of those formations.

Because both the time and areal limits of marine faunas were always indefinite, especially as regards both the time and geographical range of certain species, it is plain that it is the fauna as a whole, and not separate members of it, that must be regarded as characterizing a formation, although a single species is often sufficient for its identification within a limited district or region after its characterization has been determined by means of its fauna, aided by its physical features.

The remains of aquatic faunas only have been considered in connection with the foregoing discussions of the origin and limitation of the sedimentary formations, because the life history of those faunas only was intimately connected with their production. The greater part of the fossiliferous formations of the earth contain no other remains than those of aquatic faunas, but in many formations remains of members of contemporary land faunas and floras are found commingled with those of aquatic faunas. The latter were intombed where they originated, but the others reached their intombment by the indirect way that was described in the preceding essay. It is therefore plain that the remains of denizens of the waters in which a given formation was deposited are more characteristic of it than those of contemporaneous land animals and plants could be, because the aquatic fauna which they represent, whatever may be its value as representing a stage of biological development, was dependent for its existence upon the same conditions which were necessary to the production of the formation.

It is true that fossil remains of certain species of land animals and plants may be, and often are, found only within the limits of a certain formation. In that respect they may be regarded as among its characteristic fossils, but the time range of a land fauna or flora is likely to have fallen short of, or to have exeeeded that of an aquatic fauna whose own duration is known to have been at least in part contemporaneous, because the physical conditions which were the principal factors in establishing and extinguishing an aquatic fauna would not necessarily have materially affected the existence of adjacent and contemporaneous land faunas and floras. These questions, however, will be more fully referred to in following essays.

The foregoing remarks concerning the characterization of formations have been made with special reference to those which are more or less fossiliferous. It sometimes happens, however, that fossils do not exist, or are not discovered, in certain formations which are evidently of sedimentary origin. This may have been due in some cases to the uncongeniality as a faunal habitat of the waters in which the formation was deposited, and in others to their failure to receive any fossilizable remains of animals and plants from the land. In other cases the absence of fossils may have been due to their destruction or obliteration. The latter has probably been the case with many metamorphic rocks and with the great pre-Cambrian series of stratified rocks generally. In all these cases the formations, while they may possess more or less distinct physical characteristics, lack the chief characteristics of sedimentary formations, namely, the biological.

The occurrence of an unfossiliferous sedimentary formation as a member of an otherwise fossiliferous series is unusual, but in such a case its definition and limitation would be effectually accomplished by the underlying and overlying formations. In the case, however, of a great unfossiliferous series of stratified rocks like the pre-Cambrian it is necessary to adopt a method for their study and classification based wholly upon physical data, after the fact that they are pre-Cambrian has been determined from biological data. Such a method of classifying and characterizing those unfossiliferous stratified rocks as they occur in North America has been proposed by Prof. R. D. Irving* and afterward elaborated by others. This great series of rocks as it is developed on this continent has such distinguishing general characteristics and such magnitude and geographical extent that some geologists have thought it worthy of being assigned to a special division of study, but because no certain traces of organic forms have been discovered in them they have, so far as it is now known, only the indirect relation to biological geology that has just been referred to. Still I regard it as not improbable that those strata were once fossiliferous and that the great series was once made up of formations similar to those which have been defined on preceding pages, but it does not necessarily follow that the divisions which are now recognizable by physical characteristics correspond to those formations. It is probable that they more nearly correspond to systems or to the larger divisions of systems as they are recognized in the great scale of the fossiliferous rocks of the earth. Therefore the discussion of formations in this essay does not necessarily apply to the pre-Cambrian stratified rocks.

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* Irving, R. D.: Classification of the Early Cambrian and pre-Cambrian formations. Seventh Ann. Rep. U. S. Geol. Survey, pp. 371-399.

The following conclusions concerning formations are deducible from the facts which are stated in the foregoing paragraphs:

While they are physical objects and have only a physical existence their proper characterization is chiefly biological.

They are characterizable mainly by the fossil remains of aquatic faunas.

Neither their physical nor biological limits are sharply defined except as a result of accidental causes.

Their geographical limitations are indefinite except those which were occasioned by shore lines.

They do not necessarily bear any close relation to one another as to geographical area, thickness, or the duration of time in their accumulation.

Although they are thus unequal to one another they constitute the only available physical units for local or regional stratigraphic classification.

Because of their limited geographical extent they can not be used as units of the universal classification of the stratified rocks.

III.—THE RELATION OF FOSSIL REMAINS TO STRUCTURAL GEOLOGY.

The character and origin of fossil remains and the character and limitation of the sedimentary formations, as well as the manner in which the latter originated and became fossiliferous, have been discussed in the preceding essays. It is necessary that such discussions should have preceded those which are embraced in this and following essays, because they contain numerous statements of fact which it will be constantly necessary to refer to or to bear in mind in connection with the subjects now to be discussed and without which those subjects could not be intelligibly presented.

There are two methods by which the study of fossils may legitimately be applied to geological investigation, the following statement of the character of which is in part explanatory of the results that may be obtained by their aid. For convenience one of them may be termed empirical and the other philosophical, because in the one case results are obtained by experience and in the other by reasoning upon the various results thus obtained. Still, discrimination between these two methods can not usually be sharply drawn, because while all geological investigation is largely empirical it is always more or less philosophical. Such a division of the subject, however, besides being a present convenience, gives me an opportunity to emphasize the fact that a large proportion of the work that is done in structural geology is based mainly upon the empirical observation and collection of biological data.

Both these methods are not only important but indispensable, the one not less so than the other. Both may be, and often are, used together, but the empirical method is more largely used in practical field studies than in others, because in such studies fossils are to a large extent treated as characteristic tokens of formations or as arbitrary means of identifying them and distinguishing them from one another. Such identification necessarily constitutes one of the first steps in the practical study of structural geology, but the subsequent study of the fossils thus empirically used is necessarily more philosophical.

Furthermore, in the prosecution of field studies it is often necessary to make special philosophical use of fossils, not only with reference to questions which are discussed in following essays, but to some of those which relate more particularly to the subject of this. Among such questions are those which relate to the conditions of origin of formations, the character and quality of the waters in which they were deposited, and the various conditions of habitat of the faunas and floras whose remains characterize them.

The philosophical method of treating fossil remains, however, is largely applicable to systematic geology or those branches which pertain to the universal chronological classification of the sedimentary formations and to their correlation in different parts of the world. The naturalist studies fossil remains as representatives of the long succession of progressively and differentially developed organic forms which during geological time have existed and become extinct and of which succession the now existing forms of life constitute only the terminal portion. It is the results of such studies as these that the geologist uses in the philosophical studies referred to. While these questions are discussed in following essays this one is devoted more especially to questions pertaining to the practical study of geology in the field.

The idea of using fossils as characteristic tokens of formations by means of which they may be distinguished from one another and identified in their geographical extension began to prevail with the earliest studies of structural geology. Originally they were apparently regarded as of little or no more value in the identification of formations than was their lithological composition, to which, indeed, their use seems at first to have been merely auxiliary. Although the use of fossils soon came to be recognized as indispensable in the characterization and identification of formations, and their investigation came to constitute a leading feature in geological research, it was long before they began to be studied in a philosophical rather than in an empirical manner.

That increase in their philosophical use did not diminish their value in other respects, as is apparent from the fact that a large proportion of the practical field work of to-day is necessarily based upon the empirical use of fossils as tokens of formations. That is, a large proportion of all the field work in structural geology depends upon the specific identification of fossil remains with, necessarily, only incidental reference to their systematic biological classification, and with no necessry reference to their value in other respects. Therefore the empirical use of fossils is even now held to terms as simple as those which were employed by the early geologists. Although it is essential that geological observations of all kinds should always be made with reference to all related physical as well as biological facts which may be available, it is not to be expected or desired that this primitive empirical use of fossil remains will ever be either discarded or diminished.

The foregoing remarks are made in defense of even the simple use of fossils just indicated, because it is evident that their value in that respect, as well as in others, is often underestimated, even by some geologists. The full measure of their usefulness, however, even in the identification and characterization of formations, can be attained only by a thorough investigation of comprehensive collections, prosecuted with direct reference to, and a rational interpretation of, the biological laws that governed the existence of the respective faunas and floras which they represent, and with equally direct reference to the physical laws which governed the production of the formations which they characterize.

It was shown in the preceding essay that although formations as they are there defined are not, and cannot be, the units of a universal classification of the stratified rocks they are the true units of local or regional classification of those rocks, and their use as such is indispensable in field studies of structural geology. Therefore the accurate identification of formations is indispensable, and because of this the means of correctly identifying them is of prime importance. It is true, as already stated, that formations have really only a physical existence, but their biological characteristics become in fact a part of their identity, and these characteristics constitute the principal, and in most cases the only criteria of identification. The criteria of identification of formations will be specially discussed in Essay VI, but it is necessary to consider them briefly in this connection.

Of the two ways in which formations are naturally charaterizable one is physical and the other biological. Physical characterization may be direct or general, that is, it may be by identity of kind or kinds of rock of which the formation is composed or by its possession of that more general or indefinite property or condition which indicates homogeny.

The physical or, more specially, the lithological, characteristics of any given formation may be so different from those of an underlying or overlying one that the contrast may be an efficient aid in its identification, but this is too seldom the case to be generally relied upon, the physical difference between them being usually no greater than that which may occur between different parts of one and the same formation in its geographical extension. Again the physical identification of an unfossiliferous formation may sometimes be satisfactorily determined from its position with relation to overlying or underlying formations whose biological characteristics are known, but such methods are usually too indefinite to meet the requirements of practical field studies.

It is true that in certain regions where erosion, corrasion, and denudation have been especially active, the field geologist may trace formations continuously and completely for many miles by means of their lithological and other physical characteristics and without the aid of fossils, but usually they have become so obscured by the overlapping of one upon another, or by being overlain by glacial or other drift or the débris resulting from their own erosion, that they are exposed to view only at wide intervals, and then incompletely. It is also true, that as a result of a long series of observations at such limited exposures of formations as those just referred to, one may obtain an approximately clear idea of the identity of a formation from the physical evidence which it presents of its homogenesis. Although in late years it has become the custom of some geologists in seeking to identify formations to rely upon these indications to the exclusion of others, a careful consideration of all available relevant facts will make it plain that the peculiar value of these [illegible] consists in their availability a accessories to biological evidence. These physical indications of the identity of formations are further discussed in Essay VI. They are mentioned here only for the purpose of comparing them with biological indications.

Formations are too generally characterized only by the fossil remains of animals and plants which lived while they were in process of deposition, and the more intimate the natural relation of any of those animals and plants to the physical conditions which produced a formation the more characteristic of it are their remains. This implies that while no kind of fossil remains is to be rejected in practical studies of stratigraphical geology, there is much difference in the value of the different kinds for this purpose. These differences in value will be specially discussed in following essays.

In the preceding essay it was shown that there was an intimate relation between the geographical boundaries of each aqueous area within which the sedimentation took place that resulted in the production of a formation and those of the habitat of the aquatic fauna the remains of which are now found to characterize it. Also that each aquatic fauna began its existence as such with the beginning of the deposition of the formation and ended its faunal existence with the completion of that deposition, although, as a rule there was some genetic connection with both the preceding and succeeding faunas. Again it was shown that the conditions which attended the establishment of those boundaries and controlled the deposition of the sediments also constituted each area a congenial habitat for its aquatic fauna and that consequently the whole life history of each of those faunas was intimately connected with the production of the formation in which its remains are found, while contemporary land faunas and floras bore no such direct relation to it. Furthermore, reasons were given why it may be accepted as a fact that as a necessary consequence of the conditions of their habitat, every species of every aquatic fauna which possessed fossilizable parts, was originally fully represented in the formation to which the fauna pertained, while all other kinds of fossil remains have always very imperfectly represented the faunas and floras to which they belonged. Besides this, their presence in any formation was always the result of accident.

Although these are sufficient reasons why remains of aquatic faunas are always of greater value than any other in the identification of formations, that fact does not imply that other kinds are not of the highest value for other purposes nor that they are valueless for this purpose. For example, although land faunas and floras bore no direct relation
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ph [illegible] hich respectively inaugurated and closed its depo-
si [illegible] case have been of such a character, and that they
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changes in the contemporaneous land fauna and flora. Therefore it is to be assumed that such faunas and floras in their entirety bore an important indirect relation to the respective formations with the production of which they were contemporaneous, and that such of their remains as found intombment in their sediments would be largely characteristic of them.

Still, the incongruity of the biological relation and of the physical conditions of existence of land faunas and floras to aquatic faunas, and the accidental relation of such of the remains of the former as became fossilized to the sediments in which they were intombed render it difficult to treat the evidence afforded by fossils of terrestrial origin as concurrent with that which is afforded by aquatic fossil faunas. This difficulty is increased by the incompleteness of representation by fossil remains of land animals as entire faunas, and that of plants not only as entire floras but as individual members of them.

Furthermore, remains of land animals and plants have never been found in any of the fossiliferous formations of the earlier geological ages, and in the marine formations of the later ages* they are rarely, and usually never, found.† Therefore their study, except in cases of doubtful value, is confined to the nonmarine formations of the carboniferous and later ages. The restricted range of such studies as compared with that of the study of other fossils is the more apparent when it is remembered how small is the proportion of non marine to marine formations. These remarks are by no means to be understood as suggesting the rejection of any kind of evidence in any case or as calling in question the general paleontological, and the purely biological, value of fossil remains of terrestrial origin. It is only claimed that their value in the characterization, identification, and limitation of formations is below that of remains of aquatic faunas.

It was also mentioned in the preceding essay that the biological characterization of any formation is fully recognizable only by means of its fossil fauna or flora, each as a whole, and not by separate members of either, although separate members, especially of an aquatic fauna, because of their limited vertical range, are often sufficient for its identification after its characterization has been fully established. This fact is of importance in every estimate of the true value of fossil remains in practical geology, because, notwithstanding their paramount value as evidence in the cases referred to, no evidence in such cases is ever so complete as to be beyond the need of accessory support.

The foregoing remarks apply to that direct practical use of fossils which is necessary from the beginning to the close of every investigation of structural geology. The following apply to their more indirect use in reaching conclusions of a general character, but which are also principal value of these indications consists in their availability as accessories to biological evidence. These physical indications of the identity of formations are further discussed in Essay VI. They are mentioned here only for the purpose of comparing them with biological indications.

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* See table on Plate XIV, showing time ranges of animals and plants.

† Diatomaceous remains are not considered in connection with this statement.

Formations are biologically characterized only by the fossil remains of animals and plants which lived while they were in process of deposition, and the more intimate the natural relation of any of those animals and plants to the physical conditions which produced a formation, the more characteristic of it are their remains. This implies that while no kind of fossil remains is to be rejected in practical studies of structural geology, there is much difference in the value of the different kinds for this purpose. These differences in value will be specially discussed in following essays.

In the preceding essay it was shown that there was an intimate relation between the geographical boundaries of each aqueous area within which the sedimentation took place that resulted in the production of a formation and those of the habitat of the aquatic fauna the remains of which are now found to characterize it. Also that each aquatic fauna began its existence as such with the beginning of the deposition of the formation and ended its faunal existence with the completion of that deposition, although, as a rule there was some genetic connection with both the preceding and succeeding faunas. Again it was shown that the conditions which attended the establishment of those boundaries and controlled the deposition of the sediments also constituted each area a congenial habitat for its aquatic fauna and that consequently the whole life history of each of those faunas was intimately connected with the production of the formation in which its remains are found, while contemporary land faunas and floras bore no such direct relation to it. Furthermore, reasons were given why it may be accepted as a fact that as a necessary consequence of the conditions of their habitat, every species of every aquatic fauna which possessed fossilizable parts, was originally fully represented in the formation to which the fauna pertained, while all other kinds of fossil remains have always very imperfectly represented the faunas and floras to which they belonged. Besides this, their presence in any formation was always the result of accident.

Although these are sufficient reasons why remains of aquatic faunas are always of greater value than any other in the identification of formations, that fact does not imply that other kinds are not of the highest value for other purposes nor that they are valueless for this purpose. For example, although land faunas and floras bore no direct relation to the production of a formation, it is evident that the effects of the physical changes which respectively inaugurated and closed its deposition would in each case have been of such a character, and that they would have been so extended upon the land, as to cause important changes in the contemporaneous land fauna and flora. Therefore it is to be assumed that such faunas and floras in their entirety bore an important indirect relation to the respective formations with the production of which they were contemporaneous, and that such of their remains as found intombment in their sediments would be largely characteristic of them.

Still, the incongruity of the biological relation and of the physical conditions of existence of land faunas and floras to aquatic faunas, and the accidental relation of such of the remains of the former as became fossilized to the sediments in which they were intombed render it difficult to treat the evidence afforded by fossils of terrestrial origin as concurrent with that which is afforded by aquatic fossil faunas. This difficulty is increased by the incompleteness of representation by fossil remains of land animals as entire faunas, and that of plants not only as entire floras but as individual members of them.

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The foregoing remarks apply to that direct practical use of fossils which is necessary from the beginning to the close of every investigation of structural geology. The following apply to their more indirect use in reaching conclusions of a general character, but which are also of practical importance in all such investigations. Besides other applications that may be made of the facts mentioned in those remarks, they show the necessity for the study of the different kinds of aquatic faunas with relation to one another, and make it evident that so great a difference in their kinds and in the conditions of their origin implies a wide range of practical applicability to geological studies.

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* See table on Plate XIV, showing time ranges of animals and plants.

† Diatomaceous remains are not considered in connection with this statement.

Comparative studies of this kind are prosecuted mainly by the philosophical method and require a consideration of various biological and physical facts. Among them are those which relate to the various general conditions under which sedimentary formations were produced and the more special conditions under which the aquatic faunas lived whose remains now characterize them. The general conditions referred to are largely of a geographical character, while the more special relate to the quality of the water in which the respective faunas lived as the element of their habitation.

The fact that the fossil remains of aquatic animals generally possess inherent and unmistakable evidence as to the character and quality of the respective bodies of water in which were deposited the sedimentary rocks which are now found to contain them was recognized at an early date, and the character of that evidence is such that there never has been any important disagreement among geologists as to its trustworthiness.* Indeed they usually and properly assume that there is as little room for reasonable doubt as to the quality of the water in which each fossil aquatic fauna lived as would be the case if those waters were still subject to a gustatory test or to chemical analysis.† Admissible evidence as to the quality of the water relates only or mainly to the presence and comparative proportion of salt in, or to its absence from, the various bodies of water which have existed during geological time, and in which sedimentary deposits were made. In other words, it is the kind of evidence that indicates whether those waters were fresh, brackish, or of marine saltness. Such evidence indicates whether the water in which a given formation was deposited was marine, estuarine, lacustrine, or fluviatile, and all this evidence, although relating to physical questions, rests upon comparisons of fossil remains of aquatic faunas with corresponding parts of members of now living faunas whose structural characteristics and restrictions of habitat are known. The marine so greatly preponderate over all other kinds of aquatic faunas that it is convenient in discussing the sedimentary formations to make the general distinction of marine and nonmarine, the former term not needing definition, the latter being applied to all faunas that are regarded as having lived in either brackish or fresh waters.

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* The criteria of the character of formerly existing bodies of water are discussed in Essay VII, but they are briefly referred to here in discussing the subject of this essay.

† It is probable that the earliest oceanic waters were much less salt than are those of the present day because the earth has ever since been subjected to a process of leaching, with the oceans as a reservoir, but the comparisons here made apply mainly to comparatively late portions of geological time.

In making practical application of the evidence which has been referred to, it is the general conditions which are indicated by the special that will most need to, be considered. For example, the marine character of a fauna having been ascertained, the conclusion is legitimate, in the absence of conflicting evidence, that the area which constituted its habitat was bordered wholly or mainly by other marine areas, and that their sediments and faunas blended to a greater or less extent with one another. In other words, such a fauna indicates that its habitat was part of a great oceanic expanse which was occupied by other more or less similar faunas.

In case a fossil aquatic fauna should present intrinsic evidence of its brackish water origin the inference would be legitimate that its habitat was either an estuary or an inland sea, and in case the fauna should prove to be of fresh water origin we must conclude that the habitat was either a river or a lake. In all of these nonmarine cases the habitat had more definite boundaries than could have been the case with that of any marine fauna, and usually, but not necessarily always, a nonmarine formation has a less geographical extent than have marine formations. It is true that an estuary fauna blends in part with the adjacent marine fauna on the one hand and with the fluviatile fauna on the other, but its other limits are shore lines such as alone constitute the faunal boundaries of all other nonmarine bodies of water.

The estuarine, fluviatile, or lacustrine origin of a deposit or formation having been ascertained by means of the character of its fossil remains, aided by the accompanying physical indications, important inferences are to be drawn as to the geographical conditions which prevailed in that region at the time of its deposition. For example, the existence of an estuary deposit implies that contemporaneously with its deposition there was an adjacent body of marine water, and also a large land, if not a continental, area which was drained by the inflowing river.* Again, every lake or inland sea, the former existence of which may be determined by the character of the fossil aquatic fauna which the formation representing it contains, was necessarily surrounded by a broad land area.

The foregoing remarks apply to methods of distinguishing between formations of marine and nonmarine origin, and to the legitimate inferences that may be drawn from them, respectively, as to the physical conditions which prevailed while they were accumulating. In closing this essay it is desirable to present some remarks upon the relative value in practical geological field work of the fossils found in marine and nonmarine formations, respectively.

That the fossil remains of marine faunas are far more valuable as in-

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*There are, of course, estuaries at the mouths of those rivers which flow into lakes, but brackish water estuaries only are here referred to

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[illegible] of the water in which [illegible] the case of these waters [illegible] analyses.[1] Adm[illegible] or mainly to the [illegible] absence from [illegible] geological time. [illegible] In other words, it is [illegible] waters were fresh. [illegible] whether the [illegible] was marine, estuarine, [illegible] although relating to [illegible] remains of aquatic [illegible] living faunas whose [illegible] habitat are known. The [illegible] other kinds of aquatic faunas [illegible] sedimentary formations to make [illegible] marine and nonmarine, the former term not

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dicators of the chronological divisions of the geological scale and of the correlation of its divisions in different parts of the world than are those of nonmarine faunas is apparent to everyone who is familiar with even the general facts of biological geology, but it does not follow, and it is not true, that the latter are intrinsically less valuable than are the former in field studies of practical geology. For this practical work both marine and nonmarine fossils are treated by the empirical method already explained, and both are found to characterize the respective formations in the same manner.

Certain conditions, however, give each an advantage over the other under different circumstances. For example, the geographical range of the nonmarine invertebrate fossil faunas, especially those of fresh water, having been sharply defined by shore lines, the species which constituted them are to that extent more characteristic of the formations in which they occur than is the case with marine faunas. Certain species of the latter faunas, as already shown, usually ranged beyond the limits of the area which was occupied by each fauna as a whole.

Nonmarine formations as a rule occur singly in a series of marine formations, in which case the vertical as well as the geographical range of their invertebrate species is sharply defined. It is true that in the interior portion of North America there is a continuous series of fresh water formations and that certain of the species range from one into another. These, however, are notable exceptions to the rule referred to, and they at most only make such nonmarine faunas equal to the average marine fauna as regards exceptional vertical range of species. Again, nonmarine formations usually have the advantage of the presence of remains of plants and of land vertebrates and invertebrates, which in marine formations are usually so extremely rare as to be unavailable.

On the other hand, marine faunas embrace such a wide diversity of forms as compared with the nonmarine, and their progressive and differential evolution from epoch to epoch has been so much greater that they offer as faunas much more abundant means for the characterization and identification of formations. It is clear, however, that the opinion which some geologists have expressed or implied that the fossil contents of nonmarine formations are of little value in practical geological investigation is not well founded. The following are the principal conclusions reached in the foregoing discussions:

Formations being the only true units of local or regional stratigraphic classification, their correct identification is the first, and an indispensable, step in the practical field work of structural geology.

Although formations as such have only a physical existence, their biological characteristics are always the best, and often the only, means of their identification, and therefore the exhaustive study of fossils is of paramount importance in connection with all practical investigations of that kind.

The value of fossils in this respect is as purely practical as is that of any other aid to geological investigation, and it may be made available without reference to their great value in other respects.

Although all fossil remains are valuable for this practical use, those of aquatic faunas are more valuable than any others.

Remains of nonmarine faunas are of similar value for this purpose to those of marine origin.

IV. THE RELATION OF BIOLOGY TO SYSTEMATIC AND HISTORICAL GEOLOGY.

The preceding essay was devoted to discussions showing the importance of all fossil remains as well as the interrelative value of the different kinds of the same in the prosecution of geological field work. A leading object of that essay was to show that fossils constitute the most important of the distinguishing characteristics of all sedimentary formations and also the principal means of their identification as physical units of stratigraphic classification within any district or region. This essay is devoted to discussions of the more general relation of fossil remains to geological investigation; that is, to general discussions of the relation of biology, the science which they, together with living animals and plants, represent, to certain of the broader subjects of geological study. These subjects embrace systematic geolgy, or the general classification of the stratified rocks of the earth, historical geology, or the establishment of that classification upon a chronological basis, and correlative geology, or the adjustment to one another of the full chronological series of stratified rocks which occur on each continent or large division of the same. The latter subject, however, will be more specially discussed in Essay VI.

It has been made apparent in the preceding essays that each case of structural classification of stratified rocks based upon formations as physical units is independent of all others, and that its application is necessarily of limited geographical extent, because formations are themselves thus limited. It therefore follows that the structural geology of any district or region, embracing even an extensive series of formations, may be practically and thoroughly investigated, as regards both scientific accuracy and economic requirements, independently of that of any other district or region, especially of those regions which are not adjacent. It is now to be shown how the multitude of series of formations thus locally classified throughout the world have been grouped into a universal system of classification in connection with a scale having its divisions arranged in chronological order.

The grandest and most comprehensive of the ideas which were conceived and developed by the early geologists relates to the construction of this scale and the consequent reduction of geology to a universal system; but it is remarkable that although this idea is now known to have an almost exclusively biological basis, its original conception was not the result of correct biological knowledge as now understood, but of empirical observation of physical and biological facts and a sagacious perception of their interrelation.

It is true that while the early geologists relied mainly upon fossils as indicators of the relative age of formations, the belief was at first somewhat general among them that the consolidation of the sedimentary rocks, and also in part their displacements, were secularly accomplished and therefore that such conditions are to that extent indicators of their relative age; but these views did not long survive.

When the fossil faunas and floras which characterize each of a given series of sedimentary formations are compared with those which severally characterize the formations of the next preceding and succeeding series, and the whole are systematically compared with living faunas and floras, there is to be observed among those fossil forms, when studied in connection with an unbroken vertical range of formations, an order of successive changes and modifications indicative of a general advance in biological rank and also an indication of structural relationship. Furthermore, when the faunas and floras of a given series of formations are compared with those of other series in other parts of the world, it frequently appears that there is a close similarity between those of a certain portion of each series which indicates their correlation. In such cases an order of biological rank is to be observed similar to that which was observed in the original case. It also frequently occurs that the range of rank is found to be greater in one or both directions than is to be observed in other cases. By such means a knowledge of the order of faunal and floral, as well as of stratigraphical, succession far beyond that which could be obtained in any one region, has been acquired.

It is upon such empirical facts as these that the early geologists based their investigations concerning the chronological arrangement of the sedimentary formations of the earth, the grand result of which was the adoption of a general scheme and the construction of a corresponding scale for their classification. This scale, which in its present condition is a masterpiece of inductive reasoning, necessarily originated in Europe, because it was there that geology was first systematically studied, and it is there also that its adaptation is more complete than elsewhere. The first of the two following tables, the one to which, for the sake of convenience, the date 1840 is given, represents the scale in a condensed form as it was recognized and approved by leading geologists at, and a few years both prior and subsequent to, the date mentioned.[1]

The second table, the one bearing the date 1890, has been compiled from European text-books of geology, and is intended to represent the scale as it is now generally accepted and approved by geologists. It will of course be understood that only a general outline of the great scale which has been established by the concurrent labors of European geologists is represented by these tables, but they are deemed sufficient for illustrating the following remarks and discussions.

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[1] It is not my purpose to discuss historically any of the questions referred to in these essays, but it is proper to remark that Cuvier and Brongniart seem to have been the first to apply paleontology to the study of structural geology (1800–1812), and that William Smith did the same, apparently independently of the two authors just named, in 1816, 1817. In 1819 Brongniart advanced the idea of correlating distinctly separated formations by means of fossils. After the latter date these ideas rapidly gained acceptance, and the first steps toward the construction of a general geological scale soon followed.

*Condensed scale of the fossiliferous rocks, No. 1, 1840.**

Recent and Postpliocene.		
Pliocene		Tertiary.
Miocene		
Eocene		
Maestricht	Cretaceous	Secondary.
White Chalk		
Chloritic Series		
Gault		
Neocomian		
Wealden		
Purbeck Beds	Jurassic	
Portland Stone		
Kimmeridge Clay		
Coral Rag		
Oxford Clay		
Great Oölite		
Inferior Oölite		
Lias		
Upper New Red Sandstone	Triassic	
Lower New Red Sandstone	Permian	Primary.
Coal Measures	Carboniferous	
Mountain Limestone		
Old Red Sandstone	Devonian	
Upper Silurian	Silurian	
Lower Silurian		
Cambrian?	Cambrian?	

Condensed scale of the fossiliferous rocks, No. 2, 1890.

Recent and Postpliocene.		
Pliocene	Tertiary	Cenozoic.
Miocene		
Oligocene		
Eocene		

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*At the date here indicated there was much difference of opinion as to the proper method of dividing the scale. This table is intended to represent the leading opinion, mainly as expressed by Lyell.

Condensed scale of the fossiliferous rocks, No. 2, 1890—Continued.

Danian	Cretaceous	Mesozoic.
Senonian		
Turonian		
Cenomanian		
Gault		
Neocomian		
Portlandian	Jurassic	
Oxfordian		
Bathonian		
Lias, or Schwarzen Jura		
Rhætic	Triassic	
Keuper		
Muschelkalk		
Bunter		
Permian, or Dias		Paleozoic.
Coal Measures	Carboniferous	
Millstone Grit		
Carboniferous Limestone		
Upper Devonian	Devonian	
Middle Devonian		
Lower Devonian		
Upper Silurian	Silurian	
Lower Silurian		
Upper Cambrian	Cambrian	
Lower Cambrian		

It was the intention of the founders of this scale, as it is and has been of all other geologists, that it should represent the whole of geological time from the beginning of life upon the earth until the beginning of the epoch of human history,* and that its divisions in the order in which they are named in the tables should represent consecutive portions of that time. It is necessarily assumed that each of these time divisions was represented by sedimentary deposits wherever during its continuance bodies of water existed upon the earth, and where they did not exist the passage of time was not recorded at all, or that it was not so recorded as to be understood without reference to the aqueous record as represented by the scale. That is, it is necessarily assumed that although during every epoch of geological time there were portions of the earth's surface upon which no sedimentary deposits were made because they were then above water level, there were during every epoch large portions of it beneath waters which were constantly depositing sediments. Thus, contemporaneously with such breaks in sedimentation within certain regions as have just been mentioned, sedimentation was continuous and comparatively undisturbed in others. Therefore, notwithstanding the occurrence of numerous and extensive breaks, there has been an abundant and continuous sedimentary record made for the whole earth. It is to this continuous record that the great geological scale is applied. Although the statement that sedimentation has been continuous upon the larger part of the earth's surface during every epoch of geological time now accords with the views of all geologists, it will be seen by proposition 3, on page 291 that in certain particulars it does not agree with those of the early geologists; but this matter will be discussed on following pages.

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* This statement may be taken as a definition of the term geological time, in the use of which term no direct reference is made to siderial time.

In dividing and subdividing the scale geologists have generally recognized three grades of divisions, as is shown by the three columns of names in each of the two preceding tables, the second grade being subordinate to the first, and the third to the second. The divisions of the first grade are general, only three in number, and evidently very unequal as to the actual duration of time represented by each. Those of the second grade are more, and those of the third still more special. The divisions of the third grade may each be locally represented by a single formation or by more than one. That is, formations are not the natural units of this scale.

The different divisions of each of these three grades are unequal to one another, but for convenience of classification they are treated as of similar rank in each grade. It is not, however, to be understood that the different divisions of the same grade represent at best more than a remote approximation to equal portions of time or to equal average advances of animals and plants in biographical rank Besides this, the sedimentary accumulations which represent any one of the divisions of the respective grades may be many times greater than those of another division of the same grade, but the bulk of formations is not an index of the relative length of time within which each was accumulated, because the rate of sedimentary accumultion was always extremely variable.

In discussing the divisions of such a classification as these tables represent it is desirable that for the sake of clearness of statement each of them should have both a structural and chronological designation. That is, the general designation given to each of the assemblages of strata which constitutes a division or subdivision in such a classification ought, if practicable, to have a time correlative. The general failure of authors to agree upon such a plan is doubtless due to the natural difculty of correlating a chronological idea with physical objects which among themselves are of unequal quantity and, to a certain extent, of variable quality. In my own writings, however, I have generally used the term epoch as a time correlative of formation, and the term age as a time correlative of system,* but for present convenience I shall vary my custom in the latter respect which will be the less objectionable because the custom of geologists has not been uniform as to the general designation given to each of the three grades represented by the three columns of the tables. In referring to and discussing these tables I shall therefore apply the time term stage instead of age to systems or divisions of the second grade or middle column of the tables and the term substage to the divisions of the third grade or left hand column.

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* See for example, Geology of Iowa, White, 1870, vol. I, p. 25.

It will be seen by the foregoing statements that although the great scale in its entirety is comprehensive and trustworthy it is indefinite and unequal in its divisions and subdivisions, respectively. The significance of this indefiniteness and inequality is made more or less apparent in the discussions which are recorded on following pages.

Although the purpose of this scale is the classification of the sedimentary rocks of the earth its real units are not physical but chronological. That is, formations are not the units in this case as they are in the structural geology of districts or limited regions, but these units are such divisions of time as are indicated by the successive changes in the structure and character of the animals and plants which have existed upon the earth from the beginning of life until now. It is true, as has already been shown, that the chronological order of succession of a few formations may sometimes be determined within limited regions by means of their actually observed superposition, without reference to the fossil remains which they may contain. Such a method of determining that order, however, is wholly inadequate for general purposes because opportunities for observing successive cases of superposition are comparatively rare and because formations never possess any other than biological characteristics which originally could have suggested the idea of their age with reference to the full course of geological time. Therefore, a rational scheme of universal stratigraphic classification can have no other than a biological basis. That is, its real basis must be the evidence which fossils afford of the progressive evolution of organic forms during the progress of geological time and the various divisions and subdivisions of a resulting scale, while they must of necessity be locally recognized with reference to formations and systems, must coincide with widely recognizable secular stages in the progress of the evolution. In short, the true basis of such a scheme of classification is essentially a great biological idea to which material expression is given by its application to the successive accumulations of sedimentary deposits which now constitute the stratified rocks of the earth.

A comparison of the two preceding tables, although they represent only an abridgment of the great scale, will show at a glance how well the early geologists accomplished the work of constructing it. It will be observed that after more than fifty years of active scientific investigation the only essential changes that have been found necessary are the filling of a few gaps and the more complete definition of the Cambrian system at its base. Still, it is a fact that those pioneers of geological science builded better than they knew, for they accomplished their work at a time when the views of naturalists upon the vital principles of biology were radically different from those which now prevail.* They, therefore, misconceived the true character of the basis of the scheme upon which they constructed their scale, and yet their structure remains without need of material change after a revolution in the methods of thought upon the subjects to which its fundamental idea pertains, the equal of which has never been known in the history of scientific investigation.† That is, the scale, notwithstanding their misconception of its underlying principles, was constructed in accordance with certain immutable facts which they used wisely in their structure but interpreted wrongly as to the relation to those principles of the facts which they so clearly perceived. It is to their erroneous interpretation of facts and the influence which that interpretation has had upon later investigators that I now desire to call special attention.

Although the scale now in use was established before the truth of the progressive evolution of organic forms was accepted by naturalists and when all differences between those forms was believed to be due to special creations, general progression in average biological rank during geological time was perceived by the early geologists as well as by those of the present day, but with them it was the perception of a progressive succession in rank of faunal and floral groups of great assemblages of organic forms, and not the recognition of the principle of evolution. Therefore they sought methods of explaining the facts and conditions which they observed with reference to the geological scale which they had established that should accord with the biological views which then prevailed, and which were largely of a supernatural character. Indeed, in the absence of the now prevalent natural method of explaining these facts the supernatural method of the early geologists seems to have been necessary.

The following deductive propositions which now remind a naturalist of the articles of a creed more than of a statement of scientific principles, are presented as indicating the fundamental ideas held by the early geologists in connection with the construction of the geological scale and as illustrating the state of prevalent opinion among leading geologists upon biological subjects in their time. It is true that no one author has ever published these propositions in the exact form in which they are here presented, but I have formulated them from the published utterances of numerous authors and from my personal recollections of an active participation in geological work during a number of years immediately preceding the great revolution in methods of biological thought and investigation which has been referred to. In stating these propositions reference is necessarily made to the divisions and subdivisions of the table on page 286, representing the geological scale for 1840, and to the paragraphs preceding and following it. These propositions are:

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* It is true that during those early years of geological investigation there were a few advanced thinkers who held a belief in the progressive evolution of all organic forms, but their views were then at best only tolerated by the great body of naturalists.

† This revolution occurred about midway of the time that is discussed with reference to the two preceding tables—that is, about midway between 1840 and 1893. The fact that this time embraces nearly the whole history of really scientific geological investigation is suggestive of a hope that within less than a like number of years all the inherited effects of the erroneous views of the pioneers upon biological geology will have been eliminated.

(1) That every species of animals and plants, both living and extinct, was specially created, and that they are, and always have been, immutable. That genera, and also the higher groups into which both the animal and vegetable kingdoms are systematically divisible, are categories of creative thought, and that they also are immutable.

(2) That although secular extinction of certain species, and even genera, occurred during every stage of the geological scale, at the close of each stage, except the Tertiary, all life upon the earth was simultaneously destroyed, and that at the close of each substage life was at least in large part destroyed.

(3) That, at the close of each stage coincidently with, and the divinely ordained instrument of, the complete extinction of life there was a universal physical catastrophe, and that the close of each substage was, at least in part, physically catastrophic.

(4) That all life for each successive stage was created anew.

(5) That the life of each stage embraced specially ordained generic, or more general, types which were distinctive of and peculiar to it, and that their distribution was world-wide.

(6) That there was a special ordination of characteristic types for each substage, which received world-wide and simultaneous distribution within its narrow time limits.

(7) That no identical and few similar, specific forms were created for any two or more stages.

(8) That the world-wide distribution of the distinctive types of animals and plants which were ordained to characterize any stage or substage was effected in connection with the act by which their respective faunas and floras were created; or that in the case of species not having a world-wide distribution the typical integrity of faunas and floras was preserved by the introduction of representative, that is, closely similar, but distinct species.

(9) That by creative design the average biological rank of each new creation was higher than that of the next preceding one.

(10) That upon the fossilizable parts of the animals and plants which were created for each stage, and upon those designed to characterize each substage, was impressed not only their own structural features, but recognizable evidence of their chronological ordination.

These propositions represent only those views of the pioneer geologists which pertain to biological geology. Other views which were held by them are unassailable, even in the light of the present advance of science, and their biological views are not introduced here for the purpose of disparagement, but to show that they gave origin to certain erroneous methods which are in part retained as an inheritance by some paleontologists* even though they ostensibly accept the principles of modern biology.

It is evident from these propositions that the methods adopted by the early geologists of explaining the phenomena with which they had to deal, when any explanation was attempted, were based upon a belief in the supernatural origin and direct divine ordination of those phenomena, and not upon what is now accepted as a correct knowledge of natural laws. It will also be seen that among their leading ideas was that of sharp definition, not only of all the forms of animal and vegetable life, but of the divisions of the geological scale, and consequently of all the divisions of geological time. Of all the ideas which they conceived and held, to which proper exception can be taken, the influence of the one just mentioned, notwithstanding its inconsistency with natural laws, has evidently produced the most lasting influence upon modern geology. Some of the effects of this influence will be shown in the following propositions and in the remarks which follow them respectively:

The foregoing propositions relate to what were regarded by the early geologists as fundamental ideas in the construction of the geological scale, while the following relate to those ideas which are now held to constitute its true basis because they only accord with natural laws. These are therefore essentially a counter statement of the preceding propositions, but the principal object of their preparation is to point out the true relation of biology to systematic, historical and correlative geology. They consist largely of the statement of certain of the principles involved in the theory of organic evolution, but they are by no means intended as a full statement of those principles, nor are they presented for the purpose of either discussing or defining them as such. That is, the statements are made not for the purpose of formally ennunciating these principles, but for the purpose of making practical application of them to the subject in hand. I have selected for statement and comment such of them as I believe to be accepted by all naturalists who admit the truth of organic evolution, and I make such application of them as I believe will necessarily commend itself to all geologists who admit that truth and its applicability to biological geology.

These propositions are not intended to embrace the whole range of biological geology, but only such of its leading principles as are discussed in these essays. Therefore, a certain lack of immediate relevancy will appear in the order in which they are stated.

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* As a rule I do not use the term paleontologist to indicate a geologist who prosecutes his investigations mainly from a biological standpoint. He has no more need of a special designation than one who devotes himself to geological dynamics or to stratigraphy, and much less than one who rejects the aid of fossil remains in the latter branch of geological investigation. In the present instance, however, I refer to those who regard paleontological evidence not merely as essential in systematic geology, but as independent of physical evidence. The latter claim will on following pages be shown to be without rational foundation.

(1) All species of animals and plants have originated genetically from preëxisting forms, and therefore all are more or less mutable as regards their reproduction. These, together with the various divisions higher than species into which the animal and vegetable kingdoms are divisible, have respectively acquired their distinguishing characteristics by differential and gradually progressive evolution. The extinction of all species and other divisions of the animal and vegetable kingdoms which has taken place during geological time has always been by natural means and in accordance with natural laws. It has generally been secular and gradual, but in many cases locally or regionally accidental. No universal extinction has ever occurred.

This proposition is presented mainly as a countercheck to those portions of the preceding series of propositions which assert the special creation and periodically universal extinction of species, and also as a necessary concomitant of the propositions which follow. It is proper in this connection, however, to make some general remarks concerning species.

It was comparatively easy to define a species in accordance with the views of the early naturalists, but it is more difficult to do so in accordance with the principles of modern biology. Because of this, and doubtless in part because of the lingering influence of those early views, there is much difference of opinion as to what constitutes a species. This is especially observable among those who describe and publish fossil remains. Some treat every form which is describably different from another as a distinct species, while others treat these closely similar forms, especially if they evidently belong to the same fauna, as varieties, and apply the term species in a more comprehensive manner.

I adopt the latter method in these essays, and regard as belonging to one and the same species all assemblages of individual forms, even if they are very variable, which occur in strata of the same stage, or if they occur in adjacent or other stages, which there is reason to believe freely interbred and were capable of producing the same kind with its varieties,—that is, I regard species as being variable as well as mutable. Still, although species are more or less variable, they have a recognizable entity, for while they are mutable they possess a certain tendency to stability of characteristics which has remained through long lines of reproduction or until gradually overcome by evolutional change.

(2) Coincident with the progress of evolution, notwithstanding the retardation, inertion, and even degradation that have occurred along certain lines, there has been during geological time a general average advancement in biological rank of animal and vegetable forms, evidence of which is afforded by certain characteristics of their fossil remains. The evidence of this general advancement constitutes the ultimate standard of measures of geological time as a whole and the principal means of ascertaining the order of full succession of the events which attended the production of the stratified rocks of the earth.

It is true, as was briefly mentioned in Essay II, that the practical geologist finds numerous local indications of the relative age of formations and of the order of occurrence of geological events, such as the resting of one formation upon another, lava overflows, faults and other displacements, subaerial erosion, etc. All such indications, however, are of service only in local, or at best in regional, investigations, and although they may be numerous and of great local value, they are always so disconnected that they can never be reduced to a general system of chronological classification, or even to a part of it, without the aid of fossil remains. It, therefore, can not be too earnestly asserted that the general advancement which has occurred during geological time in the biological rank of organic forms, notwithstanding its variations and numerous discrepancies, together with their multifarious differentiation, constitutes the only means of measuring that time as a whole or of any considerable portions of it. It is to this abstract measure of time that material form has been given in the construction of the geological scale.

Notwithstanding the indispensability and general trustworthiness of this time-measure in the study of historical geology, it can not be denied that it is not comparable in precision with the standard of sidereal time, because the latter is mathematically definable, while the former is based upon past biological conditions which were subject to infinite and often great variation.

(3) The chronological features which fossils possess are not of a special character as such, but they are among those upon which their biological classification is based, all of which features have resulted from both progressive and differential evolution.

Progressive, and differential evolution were more or less completely concurrent, but it was sometimes the case that the latter was greatly in excess of the former. From progressive evolution we have successive stages in biological rank, and from differential evolution the infinite variety of forms which occur in approximately the same rank. Both are often exemplified by one and the same series of fossil forms, but in the study of historical geology the results obtained from each are of different applicability. Those of progressive evolution are directly chronological in character, and therefore of broader significance, than are those of differential evolution, the results of the latter being only indirectly chronological in character and of empirical applicability in geological studies.

Progressive evolution has produced from the great mass of life which has continuously existed upon the earth variously connected genetic lines of organic forms, the aggregate of which lines extended through the whole of geological time. The varying structure of these forms exhibits grades of biological rank, which, by their continuity and their relation to one another, become chronological in character as well as constituting the basis of their biological classification.

Differential evolution has produced a great diversity of forms in each of the principal grades of biological rank which have successively existed during geological time, and these are found by empirical study to characterize the respective stages and substages of the geological scale. While the principal evidence of the full chronological order of the stages and substages of the scale has been derived from results of progressive evolution alone, the results of the empirical studies just mentioned are of the utmost importance in systematic geology as well as in all practical geological investigations. Indeed, not only the first steps in the construction of the geological scale, but the working out of all its details, are the result of empirical study, while the result of the philosophical study of all its fossil forms followed and completed it as a chronological standard.

(4) The average rate of progessive evolution for the different branches or divisions of both the animal and vegetable kingdoms has not been the same for each in all parts of the world, nor the same for all in any one part of the world, during all the time they have coexisted.

While the various divisions of geological time as expressed in the construction of the great geological scale are satisfactorily recognizable by their respective fossil faunas and floras, each as a whole, their limits are often obscured not only by the ranging of certain specific forms from one to another, but by the relative acceleration and retardation of the rate of progressive evolution of certain of the types which are distinctive of the divisions of the scale. Such retardation and acceleration have occurred in various divisions of both the animal and vegetable kingdoms, which has not only resulted in obscuring the limits of the recognized divisions of the scale, but in imparing to some extent the relative chronological value of the characteristics possessed by fossil remains belonging to different branches respectively of the animal and vegetable kingdoms.

These differences in rate were no doubt largely due to inherent differences between those great groups of organic forms respectively, but they were also largely due to differences in the effects of the same environing conditions upon different groups; that is, the conditions which were congenial to the existence of marine, fresh water, and land faunas and land floras, respectively, or, in short, the conditions under which marine and continental life, each as a whole existed, have been so different and in many cases so incongruous that their relative rate of advancement in progressive evolution was necessarily unequal even under similar climatic and hydrographic conditions, and much more unequal when these conditions were different.

For example, in Europe a certain progressive grade was reached for the whole of animal and vegetable life which all geologists recognize as Cretaceous. In North America remains of invertebrate life, and in part those of vertebrate life, exhibit evidence of essentially the same Cretaceous grade, but associated remains of vegetable life show a much more advanced grade, while a few vertebrate types show an earlier or retarded grade, all being judged by the European standard.

The foregoing remarks apply particularly to the first part of proposition 4. The second part finds abundant illustration in the great disparity of advancement in rank between molluscan and mammalian life during Tertiary time and between molluscan and dinosaurian life during Mesozoic time. The disparity is seen to be all the greater if only the fresh water mollusca are considered, the slight differential development of which during successive epochs of geological time is mentioned and referred to in following paragraphs.

In these essays the term type* is usually employed with reference to the chronological significance of the forms or groups of forms thus designated. Their succession in time was not necessarily coincident with progressive evolution, but they were always the result of differential evolution. Their chronological value to the geologist depends upon the definiteness of the limits of their time range. Usually their time range was comparatively short, but sometimes they continued their existence through long periods of time. A considerable number of types are specially characteristic of each stage of the geological scale, but any of them were liable to range beyond its limits.

(5) The rate of differential evolution among the forms constituting certain divisions of the animal and vegetable kingdoms was greater than that among those constituting other divisions; and it was greater for some of the members of a given division under certain conditions than it was for other members of the same division under other conditions.

The truth of this proposition may be more clearly shown by examples than by explanation. Some of the most remarkable examples of slight differential evolution during a succession of geological periods being furnished by fresh water and land molluscan faunas, these may first be mentioned.

Fossil remains of numerous fresh water gill-bearing molluscan faunas have been found in North American strata belonging to nearly every geological period from the Jurassic to the post-Tertiary, inclusive, each fauna consisting of members most, and sometimes all, of which belong to genera that are abundantly represented by living species; that is, only a small proportion at most of extinct genera, and no extinct families are known to have been included in any of these faunas. In short, the differential evolution of the North American fresh water mollusca during the Mesozoic and Cenozoic eras seems to have been confined mainly to specific variation, and in many cases this also was slight. These remarks apply equally to the gasteropods and lamellibranchiates. Furthermore, the land and palustral pulmonate mollusks which were contemporary with those just mentioned seem as a whole to have been subject to little if any greater degree of differential evolution than were the others. It is true that progressive evolution in the case of all these mollusks was also very slight, but that does not explain the cause of the slight differential evolution.

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*Because the term "type" is used in these essays in a special and also a somewhat variable sense, it requires explanatory definition. It is herein used to indicate groups of animal or vegetable forms which have certain recognizable but often difficultly describable, characteristics in common. Such groups are sometimes identical with genera, but they are sometimes less, and often more comprehensive, even embracing families and, in rare cases, orders. They usually have only an incidental relation to the groups which are recognized as divisions of the systematic classification of animals and plants, but they sometimes coincide with them or constitute accessory features of such classification. Types thus designated are recognizable by general form, peculiar details of essential parts of structure, accessory features, or a general summary of peculiarities of structure or biological characteristics.

During the time that all those fresh water and land mollusks were so slightly affected by evolutional change marine mollusks were not only extremely differentiated, but many genera and some families successively became extinct and many others were introduced. During that time also some of the most important advances were made in both progressive and differential evolution of animal and vegetable forms that have ever occurred upon the earth. So far as is now known all exogenous plants began their existence since those mollusks began theirs, and the earlier ones mentioned were contemporaneous with the most flourishing period of the dinosaurs. That great reptilian subclass passed its climax of development and became extinct, and yet those mollusks were meantime but little changed.

An example of extreme differential evolution is afforded by the Trilobites, which in the early geological ages became greatly differentiated, but from the time the order became established to that of its extinction there was comparatively little advancement in biological rank. A somewhat similar example is afforded by the dinosaurs. While their rank among reptiles was the highest the difference in average rank between the earliest and latest known forms belonging to that subclass is comparatively small and little, if any, in favor of the latter forms. The Mammalia afford a notable example of both progressive and differential evolution, ranging in time from the early Tertiary and in rank ending with man.

(6) The succession of gradual mutations in the development of the leading classificatory features which characterize certain groups of fossil forms was not necessarily concurrent with consecutive portions of time.

For example, the mutations of the flexures of the dental sac which produced the various structural features of the teeth by which the different groups of the mammalia were characterized, or those of the mantle in the production of the lobes and saddles of the septa of chambered cephalopods, did not in either case occur along a single line of progressive evolution, but along numerous differential lines coincident with each of which the rate of biological progress was different from that of others. Therefore advanced stages of progress must necessarily have been reached on certain of those lines contemporaneously with much retarded stages on others, and similar stages of progress were reached at more or less widely separated intervals of time.

This statement concerning the dental features of the Mammalia and the septal features of the chambered cephalopods* is only intended to show that while they really have a good degree of chronological value they can not be relied upon to indicate consecutive portions of time, nor as absolute tokens of substages of the geological scale.

(7) The progress of secular extinction of species and other divisions of the animal and vegetable kingdoms, including the types which specially characterize the various stages and substages of the geological scale, was accelerated by adverse changes of environing conditions and were retarded by a continuance of congenial conditions. The final consummation of the extinction of the types was naturally often, and perhaps usually, caused by catastrophic changes of conditions which occurred within the limited areas to which they were reduced by approaching secular extinction.

Secular extinction of all of these forms would naturally begin in those localities which first became uncongenial and would be longest deferred where congenial conditions lingered longest. It has thus happened that certain of the types which specially characterized a given stage or substage of the geological scale have survived in some parts of the world long after they became extinct in other parts, and indeed after the close of the stage or substage which they and their associates had specially characterized. In such cases the surviving types are found associated with those which characterize a later stage or substage than the one in which they originated.

In this way, for example, it is possible that a given assemblage of strata in one region which upon *ex parte* paleontological evidence would be assigned to the Cretaceous was actually contemporaneous with another assemblage elsewhere, which, upon other *ex parte* evidence would be assigned to the Tertiary. A similar statement may be made concerning any of the other systems or stages of the geological scale with reference to those which adjoin them respectively.

It is not necessary to infer that the locally catastrophic changes which completed the final act of extinction of species and types were always, or even generally, due to violent physical movements of the earth's crust. Such physical changes as would diminish food supply, increase the number and relative strength of enemies, alter climatic conditions, or affect the quality of habitable waters were doubtless the usual immediate causes of final extinction.

(8) The geographical distribution of species within the time limits of the stages and substages of the geological scale, and consequently that of the distinguishing types which the species constitute, has been effected by natural means. Such means included not only locomotory and mechanical dispersion within those time-limits from one original center which was then the terminus of an evolutional line, but, at least in the same cases, survival in various regions by separate evolutional lines from the faunas of preceding stages and substages was also included.

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* Because these septal features were extraneous to the bodily structure and bore no known relation to that structure or to any animal function it may well be questioned whether a classification based upon them is accordant with that which their anatomical structure might have furnished. Indeed the philosophical naturalist can not be entirely satisfied with such a classification. The case is different, however, as regards mammalian dentition, which has direct relation to essential structure and dily functions.

It can not be reasonably doubted that as a rule the specific forms which constitute the fossil aquatic fauna of any stage or substage of the geological scale reached the localities where they are found by geographical dispersion from a single genetic center, even in cases of unusually great dispersion. Still, it seems impossible that all the fossil forms which geologists usually feel obliged to regard as representing separate species could have originated and become dispersed in that manner. It therefore may be reasonably assumed that each of the really or apparently identical forms which occur in different regions, but which belong to one certain stage or substage, may have reached their respective geographical stations within that stage or substage by separate evolutional lines from a common ancestral form which existed in a preceding stage, which lines were too slightly differentiated to produce new specific characteristics. In short, paleontological evidence seems to warrant the conclusion that in many cases, at least, both generic and specific forms have originated independently in different parts of the world, not only contemporaneously, but at successive intervals of time.

If species and genera really had such a diversity of origin as has been suggested, the various types which they constitute and which are held to characterize the various stages and substages of the geological scale may be assumed to have originated in a similarly diverse manner. Furthermore, the variable rate of differential evolution suggests a reason why certain of the characteristic types of a given stage or substage might naturally have survived the others and continued their existence into the next substage, as indicated in the paragraph following proposition 9.

(9) The animal and vegetable life of each stage of the geological scale was in the aggregate different as to its forms from that of all others, and each stage and substage was further specially characterized by certain generic, and also more general, types or peculiar groups of species. These types, however, were not necessarily confined within absolute time-limits.

So distinctive are the assemblages of types of organic forms which characterize each of the stages or systems of stratified rocks that, notwithstanding the exceptions mentioned in preceding paragraphs, the experienced geologist upon such evidence alone readily assigns to its proper stage of the great geological scale comprehensive collections of fossil remains from any given series of stratified rocks in any part of the world. For example, the great Carboniferous system has been by means of its fossils as distinctly recognized in Asia and in North and South America as in Europe where it was first studied, and in all those parts of the world it has been supposed to be sharply definable and wholly distinct, as to its fossil forms, from the Triassic above and the Devonian beneath. Later investigations, however, have shown that Devonian and Carboniferous types are often commingled upon the lower, and Carboniferous and Triassic types upon the upper, confines of the Carboniferous system.

Such a commingling of types is known to occur upon the confines of other systems as well as the Corboniferous, and the discovery of similar faunal conditions is to be expected in the case of any of them in all regions where the successive series of stratified rocks is complete. That is, where there is a sharply defined boundary between any two systems it has been due to such physical changes as broke the continuity of sedimentation and of life for the region in which it occurred.

(10) Although movements and displacements of the earth's crust have from time to time occurred over large portions of its surface, arresting sedimentation or changing its character and causing great destruction of life, there has never been a universal catastrophe of that kind. On the contrary, during all the time that disastrous conditions prevailed in any given area, conditions congenial to the existence and perpetuity of life prevailed in other and greater areas.

It is this persistence of congenial physical conditions over large portions of the earth's surface while smaller portions were disastrously affected that has not only insured the perpetuity of life in general, but that has insured the survival of certain chronological types of living forms in some parts of the earth after their complete extinction in other parts. Furthermore it is the evidence of the unbroken continuity of sedimentation attending those congenial conditions, as well as that of the unbroken continuity of life, which renders it difficult and often impracticable to draw distinct physical, as well as biological, lines of demarcation between contiguous stages and substages of the geological scale, especially when attempting to determine the correlation of the divisions of the scale for different parts of the world.

The second of the two sets of propositions, together with the accompanying remarks, which are recorded on the preceding pages, show that certain of the views held by the early geologists, notably those which assumed the universally sharp definition of all the divisions of the geological scale, were radically wrong. Still, it is evident to every one who is familiar with modern geological literature that those views have continued to exert an adverse influence upon the biological branch of geological investigation long after they have been formally rejected, even by those who continued to be influenced by them. The early geologists adopted methods of investigation which were consistent with their biological views, but I have shown that from the present standpoint of biology certain of those views were so fundamentally wrong that the methods which were based upon them are quite out of place in modern investigation. Still, those methods of our energetic predecessors have come down to the present time with such force and with such evidence of the general correctness of the scale which they had established by them that it has been difficult for their successors to adopt the modification of methods which has been necessitated by the great subsequent revolution in biological thought and methods of investigation.

The facts which have been presented on the preceding pages show that, while the scale which the early geologists established is a wonderful production of human reasoning and the best possible general standard which can be adopted before a comparatively full investigation of the geology of the whole earth has been made, it is not, and can not be except in a general way, of universal applicability. That is, while the respective stages and substages of the scale are recognizable only by means of their characteristic fossil remains, it has been shown that any of those characteristic forms are so liable to range from one stage or substage to another that it is impossible to sharply define the limits of stages, and often impossible to distinguish substages in one part of the world as they are known in another part.

The facts and principles which are enunciated and explained in this essay are of great importance in discussions of the relative chronological value of the different kinds of fossil remains and of the correlation of series of strata in separate regions of the earth, both of which subjects will, however, be specially discussed in following essays.

There is another subject which, if more data were available, might be profitably discussed at length in this connection. This subject relates to what may be designated as paleoclimatic conditions,* that is, to formerly existing conditions, which in certain parts of the earth were more or less materially different from those which now exist in the same parts. The evidence that such climatic changes have occurred upon the earth's surface consists of the presence of the fossil remains of kinds of animals and plants the living congeners of which could not exist in such a climate as now prevails there. For example, abundant fossil remains of arboreal floras are found in Greenland far north of the present northern limit of trees, and fossil corals are found at various localities in similar latitudes which are still farther beyond the northern limit of living coral-forming polyps.

These and similar cases must be taken as positive proof that great changes of climate have occurred upon the earth, but there are other cases which are frequently accepted as evidence of such changes that are of a more doubtful character. That is, there is much reason to believe that certain kinds of animals and plants formerly lived under climatic conditions which their nearest living congeners seem incapable of enduring. For example, the natural range of living elephants, rhinoceroses, and palms does not reach beyond a warm-temperature climate, but remains of certain species of those animals have been found where arctic winters prevail, and they are known to have been provided with a hairy protection against the cold. Remains of palms have also been found associated with those of fossil floras that indicate at least a cool temperate, if not a more severe, climate.

There is a multitude of other facts which bear upon this subject, but only these references to it are introduced here to indicate it as one of those which the geologist needs to bear in mind in all his biological investigations, especially those which pertain to correlation.

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* Παλαιός, ancient; Κλιμα, climate.

V. THE RELATIVE CHRONOLOGICAL VALUE OF FOSSIL REMAINS.

The discussions in the preceding essay of the positive value of fossil remains in systematic and historical geology have made it apparent that there is much difference in their relative value, especially as regards their use in characterizing the different stages of the geological scale and in determining the geological age of the strata in which they may be discovered. It is this subject, the relative chronological value of fossil remains, which I propose to discuss in this essay.

The basis of comparison of such values is a matter of much importance. The early geologists believed that all kinds of animals and plants were specially endowed at their creation with a certain chronological impress, but that this impress, being more distinctly recognizable in the fossil remains of some kinds than in those of others, they are consequently of greater chronological value. According to this idea the relative value of fossil remains consists only in the greater or less distinctness with which that impress can be recognized. The acceptance of the theory of the evolutional development of organic forms necessitates the rejection of this idea of the early geologists, which was one of the strongest influences in shaping their views of historical geology, but as already intimated its adverse influence is still observable in the practice of certain modern authors, even though they may theoretically disavow it.

Rejecting the idea of special endowment just referred to, we must consider the relative chronological value of fossil remains with reference to the natural laws which have produced their characteristics and governed the various conditions of their origin. Much may profitably be said concerning the comparative chronological value of the different genera, families, etc., belonging to one and the same class of any branch of either the animal or vegetable kingdom, or to different classes, but I propose to discuss only the broader relations to one another of the more general kinds of fossil remains. These discussions will relate to the time range of each of those general kinds, the various conditions under which they have been preserved, the various conditions of habitat of the animals and plants which they represent, the relative rate of evolutional development of the different kinds and their differences of reciprocal relation to one another.

No fact in historical geology is more conspicuous than that of the great differences in time range of the various kinds of organic fo some of them having ranged through the whole of the time represented by the geological scale, while others, and among them some of the biologically most important kinds, ranged through only a comparatively small part of it.

The various conditions under which the different kinds of fossil re-f

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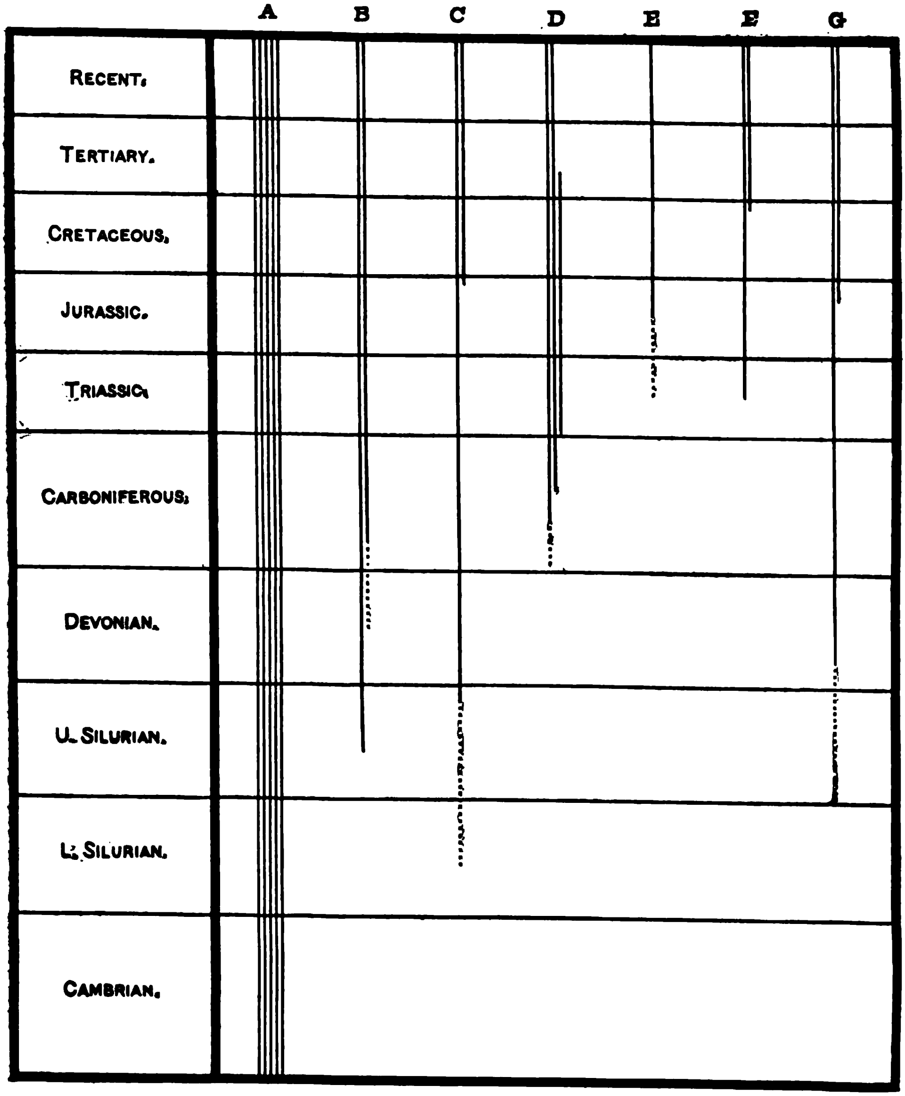

TABLE SHOWING THE TIME-RANGE OF CERTAIN KINDS OF ANIMALS AND PLANTS.

A. Marine invertebrates.
B. Non-marine and land invertebrates.
C. Fishes.
D. Batrachians and reptiles.
E. Birds.
F. Mammals.
G. Land plants.

mains have been preserved is also of great importance in this connection. Some of them have been preserved only in marine deposits and others only in nonmarine. Marine deposits have been continuous through the whole of geological time, while nonmarine deposits are not known among the older formations, and those which are known have necessarily been isolated and have had little or no direct relation either to one another or to marine deposits. The various conditions of habitat of the animals and plants which have furnished fossil remains also have much significance with reference to these discussions because of their essential relation to the differences between the kinds and to their differences of relation to one another.

It was shown in the preceding essay that while the general advancement in biological rank of organic forms which has occurred during geological time constitutes the ultimate standard of measure for that time, there has not been a uniform secular advancement for all kinds, but that there has been much difference in the rate of evolutional advancement for the various kinds of both animals and plants. Again, the differences of reciprocal relation between the various kinds of animals and plants which have furnished fossil remains are intimately connected with the causes which have produced the differences of chronological value of those remains. That is, certain kinds were not only radically different from others, but they lived under such wide differences of condition and were so nearly free from reciprocal relation to others, that they could not have produced a closely similar chronological record.

The facts thus briefly stated are of themselves clearly suggestive of the subject of this essay, that is, of wide difference in the relative value of the different kinds of fossil remains as means of characterizing the different stages of the geological scale and of determining the geological age of the strata in which they are found. These differences, however, will be discussed at some length on the following pages, but it is proper to say at the outset that while certain of the kinds mentioned are much more valuable for the purpose indicated than are others, it is inexcusable in any geologist, in attempting to determine the geological age of formations, to reject any kind as valueless, or to fail to give due weight to every accessible relevant fact, whether biological or physical.

A special grouping of the different kinds of fossil remains is more appropriate for these discussions than is a strictly systematic one, and I have therefore adopted the following: (*a*) marine invertebrates, (*b*) nonmarine and land invertebrates, (*c*) fishes, (*d*) batrachians and reptiles, (*e*) birds, (*f*) mammals, and (*g*) land plants. For convenience of reference our present knowledge of the time-range of these kinds may be presented in tabular form. The accompanying table, Plate XIV, representing the whole of geological time by its height, indicates in a general way by perpendicular lines the time range of the kinds just mentioned, and remarks in following paragraphs further explain the known range of some of the subordinate, as well as that of the principal kinds.

The horizontal spaces of the table represent the systems or stages of the geological scale. The proportionate width of the spaces which contain the names of those systems or stages is not intended to indicate the actual ratio of geological time for each, but it may be stated as the general opinion of competent investigators that the portion of the scale from the Cambrian to the Carboniferous inclusive represents a much greater length of time than does the portion from the Trias to the Tertiary inclusive. In other words, it is generally believed that the Paleozoic portion of the geological scale was of much longer duration than was that of the Mesozoic and Cenozoic portions together.

The perpendicular lines in the table, which are placed singly or in pairs or groups under letters of the alphabet from A to G inclusive, represent the time range of the kinds of animals and plants which have already been mentioned, and which for convenience of reference are again recorded opposite corresponding letters at the foot of the table. This method of grouping the different kinds of animals and plants, as already intimated, is adopted only for present convenience in making comparisons of chronological values. All the principal kinds which are designated in the usual systematic classification are, however, included in these special groups, the few that are omitted being regarded as of little or no importance in this connection. The dotted portion of certain of the lines indicates uncertainty as to the real extent of the time range which is shown by them because of imperfect or doubtful representation of those kinds by discovered fossil remains.

Of all the animals which have existed upon the earth whose remains have been discovered only those of marine invertebrates have been found to range through the whole geological scale. The time range of these important portions of the animal kingdom is represented by the group of five perpendicular lines under the letter A. The marine invertebrate life thus represented includes the Protozoa, Cœlenterata, Annuloida, Annulosa, and Mollusca, the latter including the Molluscoida. That is, it includes five of the six subkingdoms or branches of the animal kingdom.

The nonmarine and land invertebrates whose time range is intended to be represented in the table by the two perpendicular lines under the letter B are only insects and fresh-water, brackish-water, and land mollusks. The discovered fossil remains of all other nonmarine and land invertebrates are regarded as either too rare or too unimportant to be profitably considered in the comparisons which are to follow. The longer of the two lines may be taken as representing the known time range of insects and the shorter that of land and nonmarine mollusca.

The pair of perpendicular lines in the table under the letter C shows the approximate time range of all the various kinds of animal remains which have been referred to the fishes. The shorter of the two lines indicates the known range of the teliost fishes and the longer which of the other kinds, the latter including certain forms that differ materially from any living fishes.

The time range of Batrachians and reptiles, so far as it is known, is shown by the three perpendicular lines in the table under the letter D, that of the dinosaurs alone being represented by the shortest line of the three.

The known time range of birds is represented by the single line under the letter E. It is here assumed that most, if not all, the fossil tracks found in Triassic strata and formerly referred to birds are those of dinosaurs.

The two lines in the table under the letter F represent the known time range of mammals, the longer line representing that of the nonplacental and the shorter that of the placental mammals.

The known time range of land plants is represented by the two lines under the letter G. The shorter line represents the range of the dicotyledons and palms and the longer one that of all other kinds. The algæ and diatoms are omitted from the table as being of little or no importance in the comparisons and discussions which are to follow.

The earlier portion of the time-range for each of the kinds of animals and plants as shown by the perpendicular lines in the table is naturally more incompletely and indefinitely represented by fossil remains than is the later portion, because of the smaller variety and greater rarity of those earlier remains and also in most cases because of the increasing difference in character from living forms which is observable from later to earlier formations. In some cases, however, the early portion of the time range as it is now known begins so suddenly and with forms of such high biological rank as to make it evident that its real beginning was much earlier than it has yet been proved to be by actual discovery of fossil remains. The last-mentioned fact is of great importance in many respects, but it does not necessarily affect the question under consideration, because all estimates of the relative chronological value of fossil remains must be confined to the kinds already known, and the application of such estimates must be confined to those portions of the geological scale in the strata pertaining to which the remains are known to occur.

Although much the greater part of all the known fossil remains of the earth are of marine origin, it is a significant fact that most of the general kinds represented in the table are either of nonmarine or land origin. The extreme diversity of these conditions of habitat implies a wide diversity of character and suggests a wide difference of values. It is this diversity which makes it necessary to discuss the different kinds of fossil remains with reference to both habitat and conditions of preservation.

While a greater or less number of other kinds of animals, such as the Cetacea, Sirenia, birds, reptiles, etc., resort to or live in marine waters, only invertebrates and fishes have marine aqueous respiration. It is therefore evident that with the forementioned exceptions, together with that of their ancient representatives, these kinds of animals only have ever been denizens of marine waters, and it is also evident that with the exception of a few migratory kinds the remains of denizens of marine waters found intombment in no other than marine sedimentary deposits.

The character of the physiological functions of all the other animals which are represented by fossil remains made them denizens either of the land or of nonmarine waters. In view of this fact and of others which have been mentioned in Essay I, it is apparent that with few and mostly accidental exceptions their remains became fossilized only in nonmarine sedimentary deposits.

The land in the vicinity of inland bodies of water naturally constituted a more congenial habitat for such plants as have in part become fossilized than did open seacoasts, and, as shown in Essay I, plant remains were much more likely to have become preserved in nonmarine than in marine sediments. This statement is supported by the fact that, with rare exceptions, all discovered plant remains, especially such as are preserved in a classifiable condition, are found in nonmarine deposits, which are shown to be such by the character of the accompanying remains of aquatic faunas. Among the apparent exceptions to this rule are the beds of coal, and of shale containing plant remains, which are found to alternate with other beds bearing remains of unmistakably marine animals. These cases, however, are regarded as representing alternate subsidence and slight emergence of marshy land with relation to the level of shallow marine waters. Such conditions are accordant with the forementioned alternation of the remains of land plants with those of marine animals, and also with the fact that the actual commingling in one and the same bed of the two kinds of remains has very rarely been discovered.

The foregoing facts make it evident that as a rule, having only the exceptions just indicated, strata of marine origin contain no other fossil remains than those of invertebrates and fishes. It should also be remarked in this connection that fish remains are often absent from strata that contain invertebrate remains in great abundance, and that in all other cases the proportion of the former to the latter is very small as regards both numbers and variety—that is, as a rule, fish remains are comparatively so rare that a large proportion of the marine formations are found to contain no other fossil remains than those of invertebrates. Those facts also make it evident that with few and comparatively unimportant exceptions the remains of all land animals, as well as those of all land plants, are found only in sedimentary deposits of nonmarine origin.

By referring to the table on Plate XIV it will be seen that the time range of none of the nonmarine kinds of fossil remains extends much beyond the estimated later half of geological time, and that the range of a part of them is much less. It will also be observed that the time range of marine invertebrates is from the beginning to the end of the time represented by the geological scale. Therefore, there is no possibility of making comparisons between remains of marine animals and those of all other animals as well as those of land plants for a very large early part of the geological scale, because none of the latter kinds have been discovered there. Indeed, opportunities for any such comparisons for the whole Paleozoic portion of the scale, besides those which are practicable between remains of the marine animals and those of the land plants of the Carboniferous system, are very few and comparatively unimportant. It is probable that many and important nonmarine deposits were formed during Paleozoic time and that they contained the remains of nonmarine faunas, but reference is here made only to the present extent of our knowledge in that direction.

For the Mesozoic and Cenozoic portions of the geological scale opportunities are much more numerous for comparing fossil remains of marine with those of nonmarine origin than they are for the Paleozoic portion. This is because nonmarine formations are of more frequent occurrence among the sedimentary rocks of the two later eras than among those of Paleozoic era, and also because of the greater abundance and variety of the remains of nonmarine and land faunas and of land floras in those later formations. It is, however, a fact of great importance in this connection that the aggregate proportion of nonmarine formations to those of marine origin, even for the Mesozoic and Cenozoic portions of the scale, is very small.

It is thus apparent that for the Paleozoic portion of the scale it is marine formations almost exclusively with which the geologist has to deal, and that for the remainder of the scale marine formations are far in excess of the nonmarine. Indeed, they are so far in excess that, with the exception of a few regions like the interior portion of North America, for example, the occurrence of nonmarine formations is quite exceptional.

The absence of marine deposits among the formations of the earlier part of the geological scale and the great excess of the marine over the nonmarine among those of the later part, even where the latter are most abundant, is a great impediment to the comparisons which it is desirable to make between them and their fossil contents respectively. Still, this is not a greater impediment to such comparisons than is the incongruity or want of reciprocal relation not only between the marine and nonmarine, but between the different kinds of the latter.*

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*Dr. Theodore Gill has clearly pointed out the incongruity between land and marine faunas from the standpoint of recent biology. See Proc. Biolog. Soc., Washington. Vol. 2, p. 32, 1885; and The Nation, Vol. 24, p. 43, 1877.

The physical incongruity between marine and nonmarine formations is manifest in the fact that the presence of one or more of the latter in a series of the former kind of formations always implies that there have been such disturbances of physical conditions as to cause at least a local break in the continuity of marine sedimentation as well as in that of faunal succession. Such breaks also imply a greater or less interruption of the chronological record, the extent and character of which can be determined, if at all, only by indirect means. It is, however, the want of reciprocal relation between marine faunas on the one hand and nonmarine and land faunas and land floras on the other that more concerns the question of the relative value of the different kinds of fossil remains in characterizing the time divisions of the geological scale than does a similar want with reference to other kinds.

The biological contrast between marine faunas and land floras and between their respective conditions of existence is so complete that it is unreasonable to assume that the evolutional changes which have taken place in each during geological time were chronologically concurrent. Therefore, whatever of intrinsic value in the characterization of the divisions of the scale the fossil remains of the one series may possess, it is quite independent of that of the other.

It is true that the biological contrast between marine faunas and land faunas is not so complete as it is between marine faunas and land floras, but as regards interdependence and common conditions of existence the want of reciprocal relation between marine faunas and a large proportion of the members of all the land faunas is well nigh complete. Real or apparent exceptions to such completeness are observable in the exclusively marine habitat, or marine resort for subsistence, of certain mammals, reptiles, and birds, but these are cases of adaptation to conditions which are abnormal or exceptional for the respective classes to which they belong.

Notwithstanding these exceptions it is evident that during geological time there has been no necessary concurrence of rate or degree of progressive evolution between marine and land faunas, and therefore that the chronological value of the one series of faunas has in no case a necessary relation to that of the other, or no other than a common secular relation,* which is at best obscure.

The relation of the marine to the nonmarine aquatic faunas is less incongruous than it is in the case of the land faunas already noticed, the respective members of nonmarine faunas having much in common with corresponding members of marine faunas as regards zoological affinity. Such a relation, however, does not make nonmarine fossil faunas of concurrent chronological value with the marine, because of the conspicuous fact that the rate of both progressive and differential evolution has been remarkably slow in the case of nonmarine, especially fresh-water, faunas. Among illustrations of this tardiness of evolution may be mentioned the close similarity to one another of the Jurassic, Cretaceous, Tertiary, and recent fresh-water molluscan faunas, and also the fact that much the greater part of the ancient ichthyic types which have survived to the present day are found among the fresh-water fishes.

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*The difficulty or impossibility of correlating marine deposits with those of nonmarine origin is discussed at the close of Essay VI.

The foregoing comparisons have been made between marine faunas on the one hand and all other faunas and the land floras on the other. When we come to compare the various kinds of land animals with one another, and with land plants, we find that while reciprocal biological relation between them is more or less intimate in certain respects, there is no such relation as would necessarily have produced a concurrent rate of progressive evolution in all of them. On the contrary, when we come to examine the fossil land faunas and floras we find that there has been a great difference among them as to the rate of progressive evolution for each, and also a marked difference in the relative extent of differential evolution.

For example, the earliest known dinosaurs were introduced before the earliest known dicotyledonous plants. The former, after a wonderfully differentiated development, became extinct, together with the enaliosaurs, about the time of the introduction of the earliest known of the placental mammals. Other reptilian families, and even closely related genera, which were contemporary with the dinosaurs and enaliosaurs, have survived to the present day. Long before the extinction of the dinosaurs, and before the introduction of the earliest known placental mammals, a dicotyledonous flora prevailed, composed largely of families which are well represented by living plants, several of which families contain genera that are common among living floras.*

Up to the close of the Cretaceous the general rate of progressive evolution of land plants was, as shown in the preceding essay, more rapid for North America than for Europe; but it was afterward much less rapid on this continent than was that of the contemporary placental mammals.

For the time that the dinosaurs are known to have existed their rate of progressive evolution was very slow and their differential evolution very great. That is, while their differential evolution resulted in an infinite variety of forms and their adaptation to the greatest extremes in methods of locomotion and of dietetic subsistence, the average biological rank of the Jurassic and Cretaceous dinosaurs seems not to have been appreciably higher than is that of their Triassic predecessors. Indeed, it is an admitted fact that many of the latest known North American dinosaurs have strong Jurassic affinities; and it may also be remarked that the affinities of their associated nonplacental mammalian remains are similar in this respect.

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*All these comparisons are made with special reference to North American paleontology.

Two extremes of rate of evolution are exemplified by the fresh-water mollusca on the one hand and the placental mammals on the other. The evolution of the former has been slower than that of any other animals of equal biological rank, and the evolution of the latter more rapid than that of any others, even among their contemporary forms of life.

Applying the foregoing statements to the methods which have been adopted in the construction of the geological scale and in the recognition of its divisions, we observe that for the portion which may reasonably be assumed to represent fully the first half of geological time the work has been accomplished entirely by means of marine invertebrate fossils. These only were available for that purpose, but they were sufficient. We further find that the remainder of the Paleozoic portion of the scale was constructed by means of marine invertebrate remains with only the auxiliary aid of plant and fish remains. The latter aid was not really necessary, because the succession and completeness of Paleozoic marine life was unbroken, and the remains which those forms of life afforded constitute of themselves abundant material for characterizing consecutive divisions of the scale.

The opinion formerly prevailed among geologists that at the close of Paleozoic time there was a material and general break in the succession of marine life coincident with that which was assumed to have taken place in the case of land plants, and which was also assumed to have been at least approximately coincident with the introduction of dinosaurs, birds, and nonplacental mammals.

It is now known, however, that the succession of marine invertebrate life was as complete from Paleozoic to Mesozoic time and from Mesozoic to Cenozoic time as it was for any other portions of the geological scale. Furthermore the remains of Mesozoic and Cenozoic marine invertebrates are as sufficient for the characterization of those divisions of the scale as are remains of marine invertebrates for the Paleozoic portion.

It is thus apparent that there has been a continuous and full succession of marine invertebrate life through the whole time range of the geological scale, and that its remains are as sufficient as any fossil remains can be for the characterization of every one of its divisions wherever they are represented by fossiliferous rocks of marine origin. Furthermore, from the beginning to the end of geological time, there has been a good degree of uniformity of the rate of development of marine invertebrates, and the reciprocal relation of the various kinds to one another, so far as concerns its bearing upon geological questions, has always been intimate and of a comparatively uniform character. Therefore, the paleontological record which they have produced is to a great degree complete in itself and harmonious in all its parts.

On the other hand it is apparent that the longest known time range of the fossil remains of any of the other kinds of animals or of land plants falls very far short of the full range of the scale, while the range of each of the more important of these kinds is at best through only a portion of the later half of the scale. Besides this, the incongruity which has been shown to have existed between the different kinds of these nonmarine and land animals and land plants respectively, and the difference in the rate of evolution of each, were such that their respective time ranges could not have been so complemental of one another as to constitute of themselves a consecutive and harmonious paleontological record for that portion of the geological scale in which they occur. At least a record thus produced could not have been so complete as is that which has been produced for the whole scale by the combined ranges of the different kinds of marine invertebrates.

If the fossil remains of the nonmarine and land faunas and land floras can not be used conjointly as a standard for the characterization and recognition of the divisions of the geological scale it is evident that none of the kinds which they embrace can be separately so used. It has been claimed by some authors that, although their complexity of structure was the predisposing cause, the exciting cause of the remarkably rapid progressive, and the wide differential, evolution of the placental mammals was their sensitiveness to physical changes which were so slight that they produced little or no effect upon associated faunas. They further claim that this sensitiveness to slight physical changes has made the remains of those animals more valuable as indicators of the divisions of geological time than are any other fossil remains.

Whatever may have been the cause of the rapid changes which took place among those mammals it is true that their remains are often valuable for distinguishing subordinate horizons which other fossils do not clearly indicate. It is plain, however, that a chronological classification based upon such rapidly changing forms alone will not harmonize with that which we are obliged to use for all that great earlier portion of the scale in the strata of which such remains do not occur, nor with the continuation of that classification which is necessarily used for the remaining portion of the scale.

If the remains which the placental mammals have left had shown any such approach to a direct succession of faunas as have the marine, and especially the nonmarine, invertebrates they would be much more valuable in the way just mentioned than they are now found to be. That is, there are great faunal breaks among themselves so far as their succession is known, and an especially wide faunal hiatus between the earliest of them and the nonplacental mammals and the dinosaurs which preceded them, while the known succession or continuous existence of species of gill-bearing mollusks show that the stratigraphic record is continuous.

For example, certain species of gill-bearing fresh water mollusks are found associated with dinosaurian remains in the interior region of

North America, and the same species have been found in an overlying formation which is characterized by an abundant placental mammalian fauna. Such a survival of gill-bearing mollusks implies the continuation of a congenial aquatic habitat, continuous sedimentation, and a continuous record of time. In this way specific molluscan forms are found to have bridged the gap between characteristic mesozoic, and equally characteristic cenozoic vertebrate forms so far as the existence of the latter has been proved by the discovery of fossil remains. It is, therefore, evident that neither the exceptionally rapid rate of evolution like that of the placental mammals, nor the exceptionally slow rate, like that of the fresh water mollusca, can be used independently as a standard of geological time.

It has been shown on preceding pages that it is the general advancement in biological rank for all organic forms and for the whole of geological time that constitutes the ideal ultimate standard of measure for that time. It does not necessarily follow, however, that the geological scale is actually based upon the combined average rate of advancement of all those forms because this is a factor which can not be definitely ascertained. Still, in all cases it is necessary to apply that idea so far as is practicable.

In view of the facts recorded in the preceding paragraphs we must necessarily place the highest estimate of chronological value upon the fossil remains of those kinds which have existed under the most nearly uniform conditions through the whole of geological time, and which give evidence of the most nearly uniform advancement in biological rank. Accordingly the remains of marine invertebrates possess legitimate claims to a higher estimate of chronological value than do those of any other kinds of animals or of plants.

It is true that the rate of development in biological rank of marine invertebrates does not embrace the entire advance for the whole animal kingdom because it begins in the scale as it is now known with many highly organized forms and ends without including the vertebrates, but this fact does not affect any of the necessary elements of their superior chronological value which have just been mentioned. The following summary of facts relating to the marine invertebrates show their principal claims to the highest estimate of value in characterizing the divisions of the geological scale and in determining the geological age of the strata in which their remains are found.

The marine invertebrates embrace five of the six subkingdoms or branches of the animal kingdom.

They have coexisted in every stage of geological time while the known time-range of other animals, as well as of land plants, has been very much less.

The preservation of their remains having been a natural consequence of the character of their habitat they are faunally more complete than are those of any land animals, and for the same reason they are florally more complete than are remains of land plants.

They all lived under the same or closely similar conditions, and those conditions were more nearly uniform throughout all geological time than were those under which any other forms of life existed. Their remains have, therefore, produced a more nearly uniform chronological record.

Their relations to one another were wholly congruous, while the relations of all of them to all nonmarine faunas and land floras was more or less incongruous, and in many cases extremely so.

The formations containing their remains are for the whole world and the whole of the geological scale far in excess of those which contain the remains of any other forms of life, especially the remains of land plants and land animals.

VI.—CORRELATIVE GEOLOGY AND ITS CRITERIA.

The term correlative geology is not in common use but it is adopted as a present convenience in discussing the correlation of assemblages of strata as divisions or subdivisions of the geological scale as it is developed in separate regions, and the identification of formations within one and the same district or region. As here used the term correlation refers to geological systems or other comprehensive series of stratified rocks which occur in different and more or less widely separated parts of the world between which parts there is no physical continuity of strata, or none that it is possible to discover. Correlation applies to general geology, identification to local or regional investigations.

The latter may be discussed under two heads, direct and relative. Direct identification applies to formations the characteristics of which at one or more localities have been ascertained, and as these are naturally of limited geographical extent* the application is similarly restricted.

If a formation were exposed at the surface throughout its whole geographical extent its identity at all points would be self-evident, but all formations being more or less covered from view by one another or by surface débris, they are usually accessible for study only where they have been corraded by drainage streams or brought to the surface by movements of the earth's crust where their exposure has been effected by subaerial erosion and denudation. It is at such localities only that they can be satisfactorily identified, but such identification implies the actual or original continuity of the formation between all the localities at which the identification has been made.

It is the identification of formations and not their characterization which is here discussed. The latter, as indicated in Essay II, must be determined by original studies at one or more localities from a variety of data, chief among which are the biological, although the physical are always indispensable, while identification refers to a recognition of those characteristics elsewhere.

Specific identity of fossils affords the surest test of the direct identity of a formation at localities between which its physical continuity can not be traced, but lithological similarity, general evidence of homogeny and other physical indications are often efficient aids in such identification, and in case of failure of biological evidence they are often in a good degree satisfactory.

By the term relative identification is meant the recognition of the proper place of a given formation in a series the taxonomic order of which has been determined by the previous study of formations which have been directly identified. Therefore, while direct identification is confined to the geological limits of separate formations, relative identification may extend throughout a large region by the overlapping of formations. Such a recognition of the taxonomic position of formations is usually the direct result of empirical study of a given series within a limited region, but it is often the result of those philosophical studies which have been made in connection with the construction of the great geological scale, especially in cases where a wide time-hiatus exists between formations.* The latter, however, approaches correlation in character.

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*The term formation is herein used in accordance with the restricted definition and the characterization which are given in Essay II.

Identification, except in the relative cases just mentioned, is always the result of empirical studies; but correlation is more philosophically determined. The latter not only implies the existence of closely similar biological characteristics in systems or series of formations in different and widely separated parts of the world, but in each case it has reference to a similarity of relation to preceding and succeeding series of formations respectively. That is, correlation relates to the serial recognition of the various divisions of the geological scale in more or less widely separated parts of the world, and is based wholly upon biology, those divisions coinciding with stages in the evolutional progress of development of organic forms which has occurred during geological time.

In the practical study of the structural geology of a region the principal use of correlation is to apply universally acceptable names to the different groups of formation. That is, the structural geology of great regions, or even of the greater part if not the whole of continents, may be minutely and comprehensively studied and all the stratified rocks accurately classified in chronological order by means of direct and relative identification of formations and without necessary reference to their correlation with those of any other part of the world except as a means of detecting such cases of wide time-hiatus between formations as are not otherwise clearly revealed.

Because fossil remains constitute the principal criteria in the practical identification of formations it is desirable in this connection to consider the relative value of the different kinds for this purpose, although the subject has been briefly discussed and frequently referred to in the preceding essays.

Fossils being the remains of animals and plants most of the principal kinds of which lived under different physical conditions, some of them have a more direct relation than others to the formations in which they are found. Therefore they differ materially as to their relative value in the identification of formations. Naturally the remains of aquatic faunas exceed all others in value for this purpose because the faunas not only found a congenial habitat in the waters in which were deposited the formations that now contain their fossil remains, but they could have existed in no other. Their whole life history, with the minor exception of migratory fishes, especially such as entered nonmarine waters, was therefore intimately and wholly connected with the production of those formations.

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* What I have here designated as relative identification has often been by authors included under the head of correlation. I also have done so in Bulletin U. S. Geological Survey, No. 82, pp 17-25, but the more clearly to state the principles involved I herein restrict the use of that term as indicated in preceding paragraphs.

A large proportion of all the formations which are characterized by the remains of aquatic faunas contain none of land faunas and floras, but in other formations remains of the latter kind are found commingled with those of aquatic faunas. In all such cases the remains of land faunas and floras reached their intombment by accidental means while the intombment of the remains of aquatic faunas was a natural result of the character of their habitat. Moreover, all the members of extinct aquatic faunas which possessed fossilizable parts are likely to have been represented by fossil remains, because in their intombment they were not separated from their habitat, while the intombment of all remains of land faunas and floras was not only accidental but necessarily partial as regards the faunas and floras from which they were derived.*

Again, the existence of every extinct aquatic fauna had not only an intimate connection with the conditions which produced the formation in which the remains are found, but it began its existence as a fauna with the establishment of those conditions and was extinguished as such when the conditions were changed, and largely or wholly in consequence of the change. It might easily, and evidently often did, happen that changes of physical conditions which caused the extinction of one aquatic fauna and the introduction of a succeeding one would not materially affect the continued existence of the fauna and flora of the adjacent land which were contemporary with the extinguished fauna. In such a case the land fauna or flora began its existence before, or continued it after, that of the aquatic fauna, or its existence may have extended continuously from the epoch before to that after the one in which the aquatic fauna lived. In such a case also, while the aquatic fauna was characteristic of only one formation and one epoch, the land fauna and flora may have characterized two or three formations and as many epochs. Furthermore, geologists sometimes find evidence from the association of their remains with those of aquatic faunas that land faunas and floras were repeatedly and materially changed during a period within which aquatic faunas of the same region suffered comparatively little change.

It is true, as mentioned in those paragraphs of essay II, in which methods of defining and characterizing formations are discussed, that fossil remains of certain kinds of land animals and plants may be and often are found only within the limits of a given formation, and in that respect they may be regarded as characteristic of it; but that does not affect the accuracy of the foregoing statements.

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*See pages 254-261.

The foregoing comparisons of the relative value of fossil remains of aquatic and terrestrial animals can not be of unlimited application because no remains of terrestrial animals have been found in the formations of the earlier geological periods, and it is generally believed that none existed then. Indeed, such comparisons are of little applicability in the case of any formations earlier than the Mesozoic, and they mainly pertain to the Cenozoic.

The facts mentioned in the foregoing paragraphs have far-reaching significance other than that which directly relates to the identification of formations. They are to be again mentioned, but only for the purpose of showing that whatever of value fossil remains of land animals and plants may possess other than that which has been referred to, they are, as a rule, of much less value in identifying and characterizing formations than are those of aquatic animals.

Marine waters having always been of world-wide extent, and marine conditions more nearly uniform or subject to far less vicissitude than either nonmarine or terrestrial conditions, the fossil remains of the marine faunas naturally constitute a better medium for a continous chronological record by organic evolution than do those of terrestrial faunas and floras or those of fresh-water faunas. This fact, however, does not make the fossil remains of fresh-water faunas any less trustworthy than are those of marine faunas for the identification of the formations which they characterize.*

With the exception of fishes and a few mammals and reptiles vertebrates of the kinds whose remains are available in geological studies are mostly land animals, while those of invertebrates of the kinds whose remains are thus available are mostly aquatic animals. The superior value of the latter has already been pointed out; but it should be added that remains of fishes, in case of equally complete faunal representation, are of no less value than are those of aquatic invertebrates. The migratory habits of a greater or less proportion of fishes, however, has in some cases caused their remains to be commingled with those of more than one fauna and to be deposited in more than one formation.

The remains of other vertebrate aquatic animals are sometimes available in the identification of formations, but they are generally of less value than are the remains of fishes, because the aerial respiration and amphibious habits of most of them generally restricted their range within narrower limits. Furthermore, their range in geological time is even less extended than that of fishes. That is, air-breathing vertebrates are not yet known to have existed earlier than the Carboniferous, and during that age they were comparatively unimportant. Although fishes existed earlier than other vertebrates, their remains afford little material for comparison with those of invertebrates in earlier rocks than those of Devonian age. Therefore the identification of all those earlier formations, comprising a large part of the whole geological series, must be made by means of invertebrate remains alone.

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* For discussions of this subject see pages 281–283.

When considering the relative value of fossil remains of animals and plants in the identification of formations, only terrestrial plants* are worthy of notice, because of the low grade of aquatic plants proper, and because our definite knowledge of terrestrial plants extends no farther back in geological time than the Devonian. Furthermore, their remains being very rare in rocks of that age, a satisfactory comparison of plant remains with those of animals is necessarily restricted to formations of the Carboniferous and later ages.

Again, the disparity of value between the remains of aquatic and terrestrial faunas, which has already been mentioned, is not only equally great between those aquatic faunas and land floras, but for reasons stated in Essay I plant remains in all cases much less completely represent the floras from which they were derived than do the remains of aquatic animals the faunas in which they originated.

From the foregoing statements it is seen that, although fossils in all cases constitute not only much the most, but usually the only, trustworthy criteria for such identification of formations as is indispensable in the study of structural geology, the various kinds differ materially as to their relative value. This value, however, has no necessary relation to that which they may possess as indicators of geological time or of the correlation of the strata containing them with those of other parts of the world. The two values are distinct, although one kind of fossil remains may often possess both.

Other criteria of identification than those of fossil remains were briefly referred to in a preceding paragraph as being chiefly homogeny and lithological similarity, both of which are valuable aids when paleontological criteria are deficient, and both may often be relied upon in cases of the absence of those criteria. Except in the more or less constant use of lithological characteristics, that ought always to be made in connection with the biological identification of formations, those characteristics are at best of limited applicability as criteria, and they are available only in either direct or indirect relation to biological criteria. Their indirect availability is that which has just been referred to. Their direct availability is mainly in connection with what in a preceding paragraph has been designated as relative identification, because it can be made only with reference to some one or more of already known biological horizons.

Sometimes the relative stratigraphical position of a single unfossiliferous sedimentary formation may be determined by means of its relation to those which underlie and overlie it and which have been biologically identified, or the relative age of a formation of volcanic origin intercalated between known fossiliferous formations may be thus determined. Again, there may be a great series of unfossiliferous stratified rocks, such as is the pre-Cambrian, the divisions of which are identifiable by means of lithological criteria aided by the general evidence of homogeny.

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* Palustral plants are included in this designation.

In the case of single unfossiliferous sedimentary formations such as have just been referred to, their relative identity is determinable by the underlying and overlying fossiliferous formations. The same is true in case of the formations of volcanic origin which have also been referred to, the claim formerly made that the geológical age of this kind of rocks can be determined by the mineral composition having been generally abandoned. The geological age of the pre-Cambrian formations also have not been determined by any inherent evidence, but only by their ascertained stratigraphic relation to the fossiliferous Cambrian rocks. That is, their geological age or relative identification could be ascertained only by reterence to biological criteria.

While fossil remains unquestionably afford the most trustworthy and often the only means of either direct or indirect identification of formations, in the absence of these means the geologist often reaches conclusions in this respect by methods of reasoning that it would be difficult even for himself to formulate, and these conclusions are valuable in proportion to his acquirements and experience. Among these less clearly definable methods is that which takes cognizance of homogeny; that is, of a method in connection with which certain inherent lithological and stratigraphical characteristics, which are possessed by a formation or series of strata in one part of a given region under investigation, are accepted as evidence that it had a common origin with a formation or series presenting similar characteristics in another part of the same region. Such a conclusion necessarily implies that originally there was physical continuity of similar strata between such localities, and that it has either been destroyed or obscured.

This method of identifying formations is one of minor importance as compared with that which is based upon fossil remains, but unfortunately it has, especially within the last few years, been adopted by certain geologists in charge of important works almost to the entire exclusion of paleontological considerations. Although it can not be denied that in the hands of an experienced and broad-minded investigator this method of identifying formations is of great value, the fact remains that some of the most grievous mistakes that have ever thrown discredit upon geological investigation have occurred by its adoption to the exclusion of paleontological evidence.

The term correlation, as restricted by the preceding definition and distinguished from identification, is applied to a comparison of the stages and substages of the geological scale as they are respectively recognizable in distinctly separate regions. Such regions as are referred to are now separated from one another by intervening broad bodies of water beneath which there may or may not have ever been stratigraphical continuity, or by terrestrial conditions which have made it impossible to trace such continuity if it ever existed.

Thus, while correlation in this restricted sense is usually confined to a comparison of great series of stratified rocks as they occur on separate continents, it is sometimes quite as applicable to different parts of one and the same continent as is the case, for example, with the eastern and western portions of North America.

In considering the subject of correlation as thus restricted, we find that it not only depends quite as fully upon the study of fossil remains as does the identification of formations, but having reference to regions too distinctly separate from one another to have recognizable stratigraphical continuity between them, such questions as those pertaining to physical characteristics and identity are eliminated. We also find that the manner of dependence upon fossil remains in the two classes of cases is different; that is, in the one case it is mainly specific identification that is relied upon, and in the other reliance is placed only upon the recognition of various general faunal and floral types, such as are referred to on pages 296-300.

As was stated in Essay II, formations being physical units of local, but not universal, stratigraphic classification, the term identification is especially appropriate when referring to studies of their relation to one another in the field. The determination of correlation is also in some sense an act of identification; that is, it is the identification, or, more properly speaking, the recognition of the divisions or subdivisions of the great geological scale in different and distinctly separate parts of the world. The fact that the divisions and subdivisions of the scale may thus be more or less completely recognized being fully admitted by all geologists, the only question that need be discussed in that connection relates to the manner of their characterization, the distinctness of their limitation, the completeness of their representation, and to synchronism or contemporaneity and homotaxy.

The idea of correlation presupposes a standard, and as every standard must be either absolute or conventional it is necessary to consider what must be the character of one by which correlation as herein defined may be recognized, because upon this depends an intelligible discussion of the subject. If the standard of correlation is an absolute one, there can be no question as to the definiteness and completeness of its applicability in all cases and in all parts of the world where the necessary observations can be made. If, however, the standard is a conventional one, its recognition as such implies more or less uncertainty as to the definiteness and completeness of its universal applicability, but a conventional standard may be based upon such an array of admissible facts that in all cases where those facts are recognizable uncertainty and indefiniteness in its practical application are reduced to comparatively narrow limits. This, briefly, is my conception of the true character of the only standard of correlation that may legitimately be used, because it is the only one that agrees with a rational interpretation of natural laws.

It has, however, been the custom of a large proportion of geologists to regard the geological scale as it has been established in Europe as the absolute standard for the whole earth. A necessary consequence of this view is their assumption that the systems which physically constitute that scale, and at least most of the divisions of those systems, may not only be recognized, but as clearly defined in all parts of the earth as they are in Europe, if in those parts contemporaneous deposits were made and still remain intact.

While fully accepting the fact of the existence of a rational standard of correlation and of its great practical value, it is my purpose to oppose the idea of its absoluteness which is still entertained by many geologists, and which was formerly entertained by all. Before proceeding with those remarks, however, it is desirable to inquire briefly as to the origin of that idea and the probable reason of its survival, and to refer to other ideas which were entertained by the early geologists but which have long been abandoned.

One of the abandoned ideas referred to relates to the recognition of lithological identity as a criterion of correlation. This idea is indicated in various ways by the writings of those early authors and to some extent by their application of names to the divisions of the scale—such, for example, as Old Red Sandstone and New Red Sandstone* for the Devonian and Triassic systems, respectively. Another relates to the degree of consolidation or compactness that sedimentary rocks have acquired, and still another to the degree of general disturbance which they have suffered. As already stated, those pioneers regarded these conditions as indicating relative age and also as being an aid to lithological identification as a criterion of correlation.

These ideas were abandoned because they were found to be untenable even from the standpoint of their originators, and yet they are scarcely less rational than is that which ascribes absoluteness to the European scale as a standard of correlation. The only cause that I can suggest for the survival of the latter idea while the former ideas have been abandoned is a general conservative disinclination of the mind to adjust itself to new methods of thought, especially if the old methods have been rendered plausible by artificial adjustment to indisputable facts, and are intricate by the complex nature of the subject. The idea of the chronological value in the study of systematic geology of lithological character and conditions seems to have been abandoned not only because it was fallacious but because the portion of the subject to which it pertains not being complex the idea was readily dismissed. The idea of the absoluteness of the geological scale now in general use as a standard for the whole earth pertains to an unusually complex subject, involving various concurrent lines of systematic thought. It was probably for this reason that it was not fully dislodged even by the great biological revolution which has been referred to in the last essay, notwithstanding the fact that its subject is essentially a biological one.

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* The Permian was by the early geologists sometimes included with the Triassic under the name New Red Sandstone.

Originally the idea of correlation involved that of actual and complete contemporaneity. That is, in accordance with their belief in special creations the early geologists assumed that every faunal and floral type, as well as every species, having been specially created* each one of those types which characterize any given stage or substage of the geological scale was simultaneously deposited. They also believed that all the divisions and subdivisions of the geological scale were divinely ordained and sharply definable, and their acceptance of that scale as an absolute universal standard of correlation was a necessary result of that belief. Notwithstanding the great revolution in methods of biological thought and practice which has been referred to, paleontological literature abounds with proof that the idea of absoluteness of correlation is still held even by authors who ostensibly reject all the beliefs which alone could have given origin to such an idea.

Sufficient reasons have been given why formations as such can not be considered in discussing correlation, but I again refer to the fact for the purpose of emphasizing the statements that true correlation is essentially a biological and not a physical matter, that its application is necessarily restricted to divisions of the geological scale that are more comprehensive than those which may be represented by even the greatest of the formations as they are defined in Essay II, and that in the determination of such correlation specific identity of fossils can rarely be considered. It is therefore necessary to consider what divisions of the scale may be satisfactorily correlated and what are the character and attributes of the biological forms that constitute the criteria of their correlation.

Naturally the larger divisions of the scale are more readily recognizable than are the smaller, because, besides other reasons, the faunal and floral characteristics of the former are more general than are those of the latter, and their vertical range also is greater. Thus the systems, or stages, as I have designated them on preceding pages when discussing the geological scale, are readily recognizable in widely separated parts of the world by means of more or less numerous general types of fossil forms, while the characteristic types of their divisions are fewer and more special. By means of those more general indications the whole series of systems from the Cambrian to the Tertiary, inclusive, are recognizable in North America with as much certainty as they are in Europe, although some of them, the Triassic and Jurassic, for example, have not been so completely recognized.

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* See pages 291-299.

On the other hand the recognition of the substages, or division of systems, which are more or less clearly definable in Europe, has in no case been made with rational satisfaction in North America, although many geologists have attempted their full recognition on this continent, and some have even attempted that of secondary divisions of systems not only in North America but in other parts of the world, by means of their European characteristics.

I do not mean to say that at least some of the more general divisions of systems are not distinguishable in North America as well as in Europe, such for example as the Upper, Middle and Lower Devonian, Upper and Lower Cretaceous, etc. I also do not mean to say that certain of the faunal and floral types which characterize divisions or substages, such as those of the European Cretaceous from the Neocomian to the Danian, inclusive, as well as similar divisions of other systems, have not been discovered in North American strata and in those of other parts of the world.*

I claim, however, that while the systems are satisfactorily recognizable as already stated, their upper and lower limits are often illy definable, and that they often do not accord with the recognized limits in Europe, and that the same is also the case with the large general divisions of systems referred to. Furthermore, I claim that in case of the presence in North American strata of types which characterize any of those divisions of the European Cretaceous and other systems just referred to they are so often commingled with certain of those types which characterize one or more other divisions of the same system there that they can not have the same chronological significance on the two continents. That is, types which are characteristic of different divisions of a system in Europe, and which occur there in a certain order of succession, are known to occur in American divisions of the same system in a different order of succession. It is therefore evident that the presence in a group of American strata of any one, or even more, of the types which characterize a given division of a system in Europe does not prove the absolute identity of that division in America.

Although, as before stated, all the systems of the European scale have been satisfactorily recognized in North America, their upper and lower limits are not only often illy definable and sometimes discordant with those of corresponding systems in Europe, but those limits have been designated as occurring at different horizons by those geologists respectively who rely upon different kinds of fossil remains. For example, abundant remains of a flora, consisting of types which in Europe are characteristically Tertiary, are found in American strata, which are shown by all other known evidence, which is abundant, to be of Cretaceous age. Again nonplacental mammalian remains of generally accepted Jurassic types are found in American strata which other evidence shows can not be of earlier age than the uppermost Cretaceous, if, indeed, they are not of Tertiary age. Associated with these mammalian remains are those of dinosaurs which are so characteristic of that great subclass in its prime, and show so little evidence of its decadence that when they were first discovered they were believed to be of Jurassic age.

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*Although I more particularly compare North American strata with those of Europe, and oftener refer to the Cretaceous system than to others, I assume that the facts and principles involved are of world-wide application.

The cause of this association of types in the strata of certain systems, or in those of certain of its divisions as they occur in some parts of the world with those which characterize other systems or others of their divisions in another part, must be sought in the facts and principles stated in the propositions and remarks on pages 293 to 300, which propositions have been presented for the purpose of such reference. From the facts thus stated and referred to it may be seen that such a commingling of types, so far from being an abnormal condition, is wholly natural and what ought to be expected. It is thus shown that the average rate of progressive evolution which produced the types that characterize the different systems and their respective divisions was not the same in all parts of the world for each of the different branches of the animal and vegetable kingdoms, nor the same for the same part of the world during all the time those branches have coexisted.

In view of the foregoing statements of facts and principles the idea held by the early geologists, as well as by some of those now living, that identity of fossil types proves synchronism or exact contemporaneity of origin of any two or more series of strata containing them, is quite untenable. The facts which have been presented also suggest that the term homotaxy must be used with some degree of latitude as to its application to the subdivisions of systems, because the order of sequence in the occurrence of the types which characterize them, respectively, in one part of the world is in another part sometimes partially reversed or partially interchanged. That is, the taxonomy of those subdivisions as biologically indicated is not the same for all parts of the world.

Although the foregoing statements contain expressions of earnest dissent from certain views which have been more or less prevalent, it is not to be inferred that I discard any of the legitimate principles upon which correlative and historical geology are based. Indeed, the evidence is incontestable that the successive stages of the geological scale were in a general but an effective way characterized by peculiar secularly developed groups of organic types, and that those types have wonderfully wide distribution within their respective stages. With reference to such characterization it is the adequacy of those types to sharply define the limits of stages or to clearly identify substages in widely separated parts of the world that I deny. This denial, of course, implies what has before been stated, that the geological scale now in general use is not an absolute standard for the correlation of the stratified rocks of the whole earth, but I repeat what was said in connection with that statement, that this scale is unquestionably the best that it has been possible to devise, and make the additional statement that it needs adjustment rather than material change.*

The foregoing discussions having required frequent reference to certain erroneous views which have prevailed upon the subject of correlation that subject has necessarily been somewhat antagonistically presented. That is, its scope has been to a large extent negatively rather than positively indicated.

It has been shown that the presence in widely separated parts of the world of all the systems of the geological scale, as well as of some of their larger divisions, has been demonstrated by the labors of a multitude of geologists and that the fact of correlation is therefore not to be called in question. The principal questions which have been raised concern the scope of correlation or the limitation of the assemblages of strata the relation of which to respective divisions of the scale is more or less obvious. These questions are of practical application in the study of the structural geology of any part of the world other than that in which the geological scale was established, but they are of such a character that they must be conventionally rather than arbitrarily determined.

For example, in discussing the questions which have arisen concerning the earlier and later limits of the systems of the geological scale in North America the difference of opinion as to those limits have been wider and more various with regard to the later systems than to the earlier. This is because of the greater number and variety of the kinds of fossil remains to be considered in such discussions of the later systems, their difference from the earlier in this respect being plainly indicated by the table on Plate XIV, and by the accompanying statements relating to it. It is therefore evident that in reaching a conclusion as to the limitation of any of these systems, or of any of their subdivisions, it is necessary to take into consideration all available facts, physical as well as well biological. It is equally evident that it is the duty of every American geologist to hold in abeyance any final decision as to the correlation of the groups of strata which he may study with divisions of the European scale until all such facts have been duly and justly considered. In short, the idea of absoluteness in such cases is as much out of place as is the assertion or recognition of personal authority.

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*Although the views concerning correlation which are enunciated in this essay are opposed to those which were generally held by the early geologists, some of those pioneers held views which are much in accord with those herein advocated. See, for example, de la Beche, Henry T.: Sketch of a Classification of the European Rocks. Am. Jour. Sci., 1st ser. Vol. XVIII, pp. 26–37, 1830.

Although the remarks in the last paragraph refer directly to North American geology and geologists, they are equally applicable to other parts of the world when reference is made to the scale as represented by the European rocks.

Notwithstanding the great excellence of the scale now in general use and the fact that so little change has been made in it since it was first devised by the early geologists, the future progress of geological science will demand modifications the necessity for which will be especially urgent when the true character of correlation for all the principal parts of the earth has been ascertained. Hitherto correlation has been investigated with the single purpose of adjusting the series of formations which occur in each of the various parts of the world to the scale now in use, but although its general applicability to that purpose is not to be questioned the ultimate result of the study of correlation will be to modify this scale and adjust it to the systematic geology of the whole earth. That is, the scheme of stratigraphic classification which has been the main factor in adjusting the elements of systematic geology, must in turn be itself adjusted to the great system which it will have been the principal agent in producing.

There is another subject which properly pertains to correlative geology, but which does not come under the head of identification of formations and only in part under that of correlation as the term has been defined and the subject discussed on preceding pages. It relates to the great obscurity or absence of evidence of chronological relation between the marine and fresh water deposits which may occur upon one and the same continent, and also to the equally great uncertainty as to the correlation with one another of the nonmarine deposits of widely separated parts of the earth.

When the geologist is seeking to systematically classify the formations of a continent or region which consist of both marine and fresh water deposits, among the physical facts with which he is confronted is that in no case can a formation of one of these kinds be continuous with one of the other kind because they were necessarily deposited in separate bodies of water. Therefore there can in no case be any direct physical proof of contemporaneity of a fresh-water with a marine formation, and there can be no physical indication of chronological relation between them except in case of observable superposition. These remarks are made with special reference to intracontinental fresh-water deposits on the one hand and border-region marine deposits on the other.

He is also confronted with the biological fact stated on preceding pages that the fossil faunas pertaining to fresh-water formations are so different from those pertaining to marine formations, and the two kinds are so incongruous in their respective characters, even in case of actual contemporaneity of origin, that they can not be used as concurrent chronological evidence.

The latter statement applies chiefly to the remains of aquatic faunas, but the case is little if any changed by the association with them of remains of land faunas and floras unless such faunas and floras should be represented in the fresh-water as well as the marine formation. Such association and identity are to be regarded as the only direct evidence of contemporaneity of a fresh-water and marine deposit. All other evidence is indirect and of more or less uncertain value.

Such a dual commingling of remains of a land fauna and flora with those of aquatic faunas implies that the two bodies of water in which the commingling took place were separated by a land area, the whole breadth of which was occupied by the fauna and flora represented by the remains. It also implies that those remains reached their intombment in the sediments of both bodies of water in the manner described in Essay I. It is a fact, however, as already pointed out, that remains of land animals and plants are very rarely found in marine deposits, even in case there is reason to believe they lived abundantly in the vicinity of the waters in which those deposits were made. This circumstance greatly lessens the chances of discovering direct proof of contemporaneity of fresh water and marine formations.

The indirect evidence of contemporaneity of fresh water and marine formations which may occur upon one and the same continent is in part that which is afforded by the position of each in their order of succession in a series of formations of known geological age, and in part that which pertains to the general subject of correlation. I have already shown that the best of the evidence which pertains to that subject, especially when applied to so small a portion of the geological scale as is represented by even the greatest of the fresh water formations or series of deposits, is of very uncertain value. I may now add that such evidence is still less valuable when it rests upon the remains of fresh-water faunas alone, because of their remarkably slow evolution, both progressive and differential, during the whole of that portion of geological time in which they are known to have existed. It should also be stated that whatever of accuracy may have been attained in assigning the fresh water formations of Europe to their respective taxonomic positions in the geological scale it does not necessarily follow that fresh water formations upon other continents bearing closely similar faunal and floral fossil remains can be assigned upon such evidence alone to exactly the same taxonomic positions. Therefore, in attempting to correlate interior fresh-water formations with border region marine formations, such as those which occur in North America, for example, the geologist must, as a rule, to which no exceptions are yet known, rely upon general indications and cumulative evidence.

VII. CRITERIA OF PAST AQUEOUS CONDITIONS.

Among the more conspicuous facts in geology are some of those which relate to the manner of origin as well as to the original and present condition of the sedimentary formations. These subjects have been discussed at some length in Essay II, and among those discussions are some references to the character of the water in which each formation was deposited. Studies of the sedimentary formations, especially those made from a biological standpoint, have demonstrated that the bodies of water in which they were deposited were of the various kinds that are now known; that is, some were marine, some fresh, and some brackish.

It is by no means for biological reasons alone that it is desirable to obtain a knowledge of the character of formerly existing bodies of water and of the character of their respective aquatic faunas. On the contrary, such knowledge conveys important information concerning various subjects in general geology, notably concerning formerly existing physical conditions and many of the physical changes which took place from epoch to epoch of geological time. For example, the presence of a marine formation within any given geographical area shows that when it was deposited that area was beneath ocean level, and consequently that marine waters prevailed there. The presence of a nonmarine formation shows that land areas surrounded the body of water in which it was deposited and separated it more or less completely from marine waters. Therefore, an extensive nonmarine formation necessarily implies that a large land area, which may have been of continental extent, surrounded the body of water in which it was deposited.

In the present advanced state of geological knowledge the distinguishing characteristics of marine formations are well understood, because they have been exhaustively studied by geologists, and found to agree in general character with the faunas and deposits of existing seas, and because opportunities for the study of these formations are abundant in almost all parts of the world. For various reasons the distinguishing characteristics of nonmarine formations are generally not so thoroughly understood as are those of marine origin, among which reasons are their comparative rarity and usually their comparatively small geographical extent. Usually, also, they are not so abundantly fossiliferous as are marine formations, and, therefore, the principal means for their characterization are often not available. Moreover, these formations require some modification of the usual methods of investigation because they are themselves of different kinds, as is shown by inherent evidence possessed by each. and because they have in common certain characteristics which distinguish them from those of marine origin.

The facts which constitute the evidence as to the variety and character of the nonmarine formations, and that of their distinction from those of marine origin, are usually well understood by those geologists who are also naturalists because the subject to which they relate is mainly biological, but they are often not so well understood by the general reader, nor by those who pursue their geological studies wholly upon physical grounds. For these reasons the following statements and discussions, while they are in some respects necessarily technical, are, so far as practicable, expressed in an elementary manner.

The evidence that the greater part of the sedimentary rocks of the earth, those which constitute the formations containing the records of its past biological history, are of marine origin is based almost wholly upon the character of their contained fossil remains, and is, as has just been intimated, so abundant and complete that it can not be seriously questioned. That is, it is evident that they were deposited either in oceanic waters or in those of similar saltness whose geographical extent were more restricted by land areas, such, for example, as the present oceans on the one hand, and the Mediterranean and Red seas on the other. All these are designated as marine deposits, and the waters in which they were formed are understood to have rested at that worldwide level which is usually termed sea level, but which is herein written ocean level, because in this essay the term sea is used in a somewhat restricted sense.

The other sedimentary rocks were deposited in other than oceanic waters. Most of them so much resemble marine formations in lithological and stratigraphical character, that it is only by means of the peculiar character of their fossil remains that it is known that their deposition took place either in fresh waters or in those which contained salt in less proportion than it is contained in oceanic waters. All these are designated as nonmarine deposits. They usually occupy smaller districts than do marine deposits but a few of them rival the latter in thickness and geographical extent.

Nonmarine deposits are more varied in both character and origin than is indicated by the mere evidence which they may afford that salt was present in, or absent from, the waters in which they were accumulated, because the physical conditions were in each class of cases considerably different. Under the head of nonmarine sedimentary deposits are placed those which, from the inherent evidence they respectively afford, are assumed to have been formed in fluviatile, estuarine or lacustrine waters, or in the waters of lagoons, bays, or inland seas. The first three terms just mentioned are of themselves sufficient to indicate that the deposits to which they are applied were laid down in formerly existing rivers, estuaries or lakes. There are certain other nonmarine deposits with which the geologist sometimes comes in contact, namely, those of littoral and of palustral origin. The former are produced along the shores of broad bodies of water and the latter in the swamps and shoals which frequently border the same.

The terms lagoons and bays as here used are applied to such partially landlocked bodies of water as now exist along oceanic borders but which are often, at least in part, of less than marine saltness because of inflowing streams. The restricted use in this essay of the terms lake and inland sea is indicated in the following paragraphs:

In accordance with the elementary nature of these remarks it is thought desirable to briefly characterize the various kinds of existing bodies of water in which sediments similar to those which constitute the various sedimentary formations are now in process of deposition. Such a characterization is made to consist in part of an explanation of the special terms just referred to.

The term lake is properly applied, and ought to be restricted, to inland bodies of fresh water. It will be so used in this essay except in those cases where a contrary practice has resulted in a public recognition of such proper names as Great Salt lake, etc.

The source of the water supply of lakes is rainfall, which is drained into them from the surrounding land. It is therefore fresh in the ordinary acceptation of that term, but as it enters the lake it always contains at least a minute proportion of soluble salts derived from their original home, the land, by leaching. The amount of salts in such cases being inappreciable by gustatory test, lacustrine waters are properly designated as fresh, but to remain fresh a lake must have free outflow and not excessive evaporation from its surface. Otherwise it will become distinctly saline by the gradual accumulation of soluble salts which inflowing streams constantly bring from the land.

The term inland sea, as used in connection with the terms indicating other bodies of water and with reference to certain formations with which the geologist sometimes has to deal, is applied to any body of water more or less completely surrounded by land which holds in solution a sufficient proportion of saline matter to modify or characterize its aquatic fauna, or which holds a so much greater proportion as to be sufficient to prevent the existence in it of such a fauna. Therefore an inland sea, especially one that has an outlet, differs physically from a lake only by the presence of at least a readily appreciable amount of soluble salts in its waters. This restricted use of the term sea is warranted by prevalent custom with reference to the Black, Caspian, Dead, and other existing seas.

While the difference between inland seas and lakes is important as regards their respective aquatic faunas the distinguishing character of both is subject to change because in both cases it depends upon physical conditions the stability of which is uncertain, and because any considerable change of those conditions will result in a change of character. For example such a change in the physical conditions which surround a lake as would reduce the proportion of outflow to influx of water and increase evaporation from its surface would, according to the definition just given, change it to an inland sea. That is, soluble salts would accumulate in its waters to such an extent and of such a character as to modify or destroy its aquatic fauna. A reversal of such conditions would change an inland sea to a lake, because soluble salts would cease to accumulate in its waters and the previous surplus would gradually be removed by the free outflow which would result from such a change.

Inland seas may hold either more or less saline matter in solution than does the ocean. In those which by reason of having no outlet hold more, or hold a large proportion of other salts than sodium chloride, little or no gill-bearing animal life exists. Such seas may lie above ocean level, as does Great Salt lake, in Utah, or below it, as does the Dead sea.

But the waters of some existing inland seas which have no outlet have not yet become so impregnated with soluble salts as to destroy, or to prevent the accession of aquatic life. This is at present the condition of the Caspian sea, excepting some of its bays where from excessive evaporation the water contains an excess of saline matter, but if surrounding physical conditions continue the same as they now are the present average degree of saltness of this sea will continually increase. Its surface being more than 80 feet below ocean level it can of course have no outlet. The land area which is drained into it, being very large there is a considerable and constant accession of saline matter to its waters. Therefore it can not be doubted that if surrounding conditions should remain unchanged the natural increase of soluble saline matter will ultimately destroy all aquatic life in this sea.

The Black sea is an example of an inland sea lying nearly at ocean level, the difference between its level and that of the Mediterranean and of the ocean really amounting to little or no more than the short and slight river slope of the Bosphorus and of the Hellespont. The proportion of soluble salts in the waters of this sea, like those of the Caspian, Baltic, and other seas, differs greatly in different parts and at different depths, the average proportion being less than that of the oceans; but any cause which should diminish or increase its supply of drainage water would increase or diminish its average saltness, as already explained; and such increase or diminution would correspondingly affect the character of its aquatic fauna.

The general statements contained in the last three paragraphs concerning the conditions which prevail in connection with existing lakes and inland seas, and the circumstances upon which those conditions depend, are introduced here for the purpose already indicated, and also that they may be referred to in connection with the criteria which are discussed in the following paragraphs:

Because the waters in which even the latest of the sedimentary formations of the earth were deposited have long ago passed away, and their beds changed to dry land, the grounds upon which geologists assume that of the formations which they have to investigate, some

It is apparent from the foregoing remarks that upon physical evidence alone it is not practicable to satisfactorily classify the sedimentary formations of the earth in such a manner as to serve the purpose of thorough geological investigation. Therefore such data are in this, as in most other cases, chiefly valuable as being accessory to the evidence afforded by biological data.

The biological criteria which are relied upon by geologists to distinguish from one another the sedimentary formations which have been produced in marine waters, or in those of inland seas, lakes, rivers, or estuaries, relate to the characteristics of faunas which now inhabit those waters respectively, and to the differences from one another of such faunas. That is, the conclusions which geologists reach concerning the questions just indicated are based upon now-existing physical conditions, upon the known character, structure, and habits of animals with relation to those conditions, and upon the assumption that in past geological epochs animals of a given character and structure had similar habits, and lived under conditions similar to those which are congenial to their living congeners.

To aid in defining these criteria it is necessary to review the animal kingdom as it now exists, and to select for consideration those portions of it which furnish data upon which to base the necessary definitions. This selection is based mainly upon the function of aqueous respiration, because it is only animals possessing this function that have a direct relation to the character of the water in the sediments of which their remains may become intombed, and because these sediments and their organic contents are similar in their origin to those which constitute the fossiliferous formations with which the geologist has to deal. Land animals are only briefly referred to in this review because they have at best only incidental relation to the character of the respective bodies of water near which they live and to the sediments which are deposited in them, and for a similar reason plants also will be only briefly considered. Still, remains of land animals and plants have an indirect value in this connection. For example, it is obvious that such remains are more likely to find intombment in inland than in marine waters. We also may assume that they rarely reach those of the open ocean or that they quickly become destroyed by the triturating action of the waves if they reach oceanic waters.

All those aquatic animals whose bodies possess no internal or external skeleton, or such portions as resist decomposition after death, are also excluded or only incidentally mentioned, because it is those parts only that really become fossilized, as has already been explained in Essay I, and also because in the application to paleontological investigation of the facts to be presented in this review reference can be made only to the fossil remains of animals similar to those now living. All extinct animals are also excluded from this review because it is these to which the criteria based upon living forms are to be applied.

VERTEBRATA.

Although the Vertebrata constitute the highest division of the animal kingdom, for the reasons just mentioned, comparatively few of them except the fishes have a direct bearing upon any inquiry concerning the character of formerly existing bodies of water. That is, much the greater part of all the other vertebrates consist of land animals the natural habitats of which have at best only an indirect relation to the character of the waters in the sediments of which their remains may find intombment.

Mammalia.—The Mammalia are so generally dwellers upon the dry land that while a few are amphibious in their habits only the orders Cetacea and Sirenia and the Phocidæ and Odobænidæ of the order Carnivora are confined to an aquatic habitat, at least so far as concerns their locomotion. Besides this, all these animals being air-breathers their aquatic habitat may be regarded as a matter of special adaptation.

Fossil remains of any of the larger Cetacea may be taken as presumptive evidence of the marine origin of the deposits in which they may be found, but so many of the smaller members of that order live in estuaries that other evidence is usually required to determine the character of the deposits in which fossil remains of such animals occur. Because the structure and habits of the Sirenia restrict them to an estuarine or littoral habitat, fossil remains of such animals have much significance as to the character of the deposits in which they may occur, and as to the proximity of the land to the place where such deposits were made. Although the Phocidæ and Odobænidæ usually inhabit marine waters, they often range into estuaries and occasionally, but rarely, some of the former inhabit fresh waters. Therefore, fossil remains of such animals is strong presumptive, but not positive, evidence of the marine origin of the formations in which they may be found.

The foregoing remarks apply to those mammals which live in, or habitually resort to the water, but the larger part of all discovered fossil mammalian remains are those of strictly land animals. The manner in which such remains have found intombment in aqueous sediments, and the probable reasons why they are much oftener found in nonmarine than in marine formations have been indicated on preceding pages.

Aves.—As a class, birds have little bearing upon the subject of this review, because their respiration is aerial, and comparatively few of them habitually live in the water as a permanent habitat. Furthermore, with apparently the exception of the Spheniscidæ and some of the Laridæ, those which resort to an aquatic habitat find saline and fresh waters equally congenial. Avian fossil remains are therefore of comparatively little value as indicating the character of the water in which any given formation was deposited. Still, as is the case with the mammals and other land animals, avian remains are more likely to be found in the sediments of inland than of marine waters.

Reptilia.—All reptiles are air-breathers, and a large part of them are strictly land animals. Many are amphibious, and some are habitually aquatic in their habits. Among aquatic reptiles are the Hydrophidæ and some of the Chelonia, which live in marine waters, and others of the latter order which live in fresh waters. The Crocodilia also usually inhabit fresh waters and the shores of the same, but they frequently range into the saline waters of estuaries and lagoons. The greater part of all living reptiles of aquatic habits, however, are found in fresh waters, and therefore fossil reptilian remains referable to living families are regarded as more likely to indicate a nonmarine than a marine origin for the formation containing them.

The abundance and great variety of known fossil reptiles show that the class is only partially represented by all those now living. Furthermore, most of the extinct reptiles differed so much from any living kinds that comparatively little inference may be drawn as to the character of their respective habitats by a consideration of those of living reptiles. The character of the habitat of those of extinct reptiles must be learned mainly from their osseous structure and their dentition; but in the case of those whose aquatic habitat is thus determined, the marine or nonmarine character of the waters in which they lived is rarely indicated. Therefore, while a great, and doubtless the greater, part of the preserved remains of extinct reptiles were intombed in nonmarine sediments, whether those sediments were deposited in brackish or fresh waters must usually be learned, if learned at all, from other evidence than that which is furnished by the remains themselves.

Batrachia.—In their larval, gill-bearing condition all Batrachians are denizens of fresh waters, usually those of pools and marshes. A few of them retain their gills and fresh-water habitat during life, but most of them become air-breathers. A part of these become denizens of the dry land, but the remainder continue to live in the palustral habitat in which their larval stage was passed. Therefore it is assumed that batrachian fossil remains are much more likely to be found in strata of fresh, than of marine, or even of brackish, water origin.

*Pisces.**—Because all fishes have aqueous respiration it is desirable for the present purpose to review the whole class by families. The general facts concerning the habitat of each family are well exhibited by the following tabular arrangement of their names, the three columns of the table representing marine, brackish, and fresh waters, respectively. The occurrence of the name of a family only in the left hand column indicates that no representative of it is known in any other than marine waters; and in case the name occurs only in the right hand column an exclusively fresh-water habitat is indicated for that family. The occurrence of the name of a family in more than one of the columns indicates that it has representatives in more than one of the three kinds of habitat. The two kinds of cases first mentioned need no further explanation, but a variety of facts connected with the latter kind need to be considered. These will be briefly stated in the series of explanatory notes following the table, and certain other facts and considerations will be presented in the closing paragraphs of this review.

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* The classification here used is that of Dr. Theodore Gill in his arrangement of the families of fishes as published in Smithsonian Miscellaneous Collections No. 247, pp. 1-25 and personally revised by him for this essay. Dr. Gill has long had in hand an elaborate revision of this classification; but that which is here presented is deemed sufficient for the illustration of these discussions.

TELEOSTEI.

Marine.	Brackish.	Fresh.
Orthagoriscidæ		
Tetrodontidæ		Tetrodontidæ.
Triodontidæ		
Ostraciontidæ		
Balistidæ		
Triacanthidæ		
Hippocampidæ	Hippocampidæ	
Syngnathidæ	Syngnathidæ	Syngnathidæ.
Solenostomidæ		
Maltheidæ		
Lophiidæ		
Ceratiidæ		
Antennariidæ		
Soleidæ		Soleidæ.
Pleuronectidæ	Pleuronectidæ	Pleuronectidæ.
Macruridæ		
Congrogadidæ		
Fierasferidæ		
Ophidiidæ		
Brotulidæ		Brotulidæ.
Brotulophididæ		
Bregmacerotidæ		
Ranicepitidæ		
Gadidæ		Gadidæ.
Merlucliidæ		
Lycodidæ		
Ateleopodidæ		
Xenocephalidæ		
Ammodytidæ		
		Gadopsidæ.
Cryptacanthidæ		
Stichæidæ		
Xiphidiontidæ		
Acanthoclinidæ		
Chænopsidæ		
Nemophididæ		
Anarrhichadidæ		
Cebidichthyidæ		
Blenniidæ	Blenniidæ	Blenniidæ.
Patæcidæ		
Batrachidæ	Batrachidæ	Batrachidæ.
Leptoscopidæ		
Dactyloscopidæ		

TELEOSTEI—Continued.

Marine.	Brackish.	Fresh.
Uranoscopidæ		
Trachinidæ		
Trichodontidæ		
Gobiesocidæ		
Liparididæ		
Cyclopteridæ		
Platypteridæ		
Callionymidæ		
Gobiidæ	Gobiidæ	Gobiidæ.
Triglidæ		
Agonidæ		
Cottidæ		Cottidæ.
Platycephalidæ		
Hemitripteridæ		
Scorpænidæ		
Chiridæ		
Scaridæ		
Siphonognathidæ		
Labridæ		
Pomacentridæ	Pomacentridæ	
		Cichlidæ.
Embiotocidæ		Embiotocidæ.
Gerridæ	Gerridæ	
		Helostomidæ.
		Anabantidæ.
		Osphromenidæ.
Polynemidæ	Polynemidæ	
Acanthuridæ		
Amphacanthidæ		
Toxotidæ		
Chætodontidæ		
Ephippiidæ		
Xiphiidæ		
Trichiuridæ		
Scombridæ		
Carangidæ		
Drepanidæ		
Coryphænidæ		
Nematistiidæ		
Stromateidæ		
Zeidæ		
Pteraclididæ		
Bramidæ		
Lamprididæ		
Dianidæ		
Kurtidæ		
Capridæ		
Nomeidæ		
Sillaginidæ		
Chænichthyidæ		
Harpagiferidæ		
Nototheniidæ		
Bovichthyidæ		
Latilidæ		
Mullidæ		

TELEOSTEI—Continued.

Marine.	Brackish.	Fresh.
Polymixiidæ		
Monocentridæ		
Berycidæ		
Sciænidæ	Sciænidæ	Sciænidæ.
Sparidæ	Sparidæ	
Pimelepteridæ		
Mænididæ		
Pristipomatidæ	Pristipomatidæ	Pristipomatidæ.
		Centrarchidæ.
Serranidæ	Serranidæ	Serranidæ.
		Percidæ.
Centropomidæ	Centropomidæ	Centropomidæ.
Pegasidæ		
Priacanthidæ		
Hoplegnathidæ		
		Nandidæ.
Plesiopidæ		
		Polycentridæ.
Cirrhitidæ		
		Aphredoderidæ.
Sphyrænidæ		
Echeneididæ		
Oxudercidæ		
		Comephoridæ.
Trachypteridæ		
Lophotidæ		
		Luciocephalidæ.
		Ophiocephalidæ.
Trichonotidæ		
Cepolidæ		
Psychrolutidæ		
Atherinidæ	Atherinidæ	Atherinidæ.
Tetragonuridæ		
Mugilidæ	Mugilidæ	Mugilidæ.
Gasterosteidæ	Gasterosteidæ	Gasterosteidæ.
Aulorhynchidæ	Aulorhynchidæ	
Aulostomidæ		
Fistulariidæ		
Centriscidæ		
Amphisilidæ		
Belonidæ	Belonidæ	Belonidæ.
Scomberesocidæ	Scomberesocidæ	Scomberesocidæ.
		Amblyopsidæ.
		Esocidæ.
		Umbridæ.
Cyprinodontidæ	Cyprinodontidæ	Cyprinodontidæ.
		Characinidæ.
		Percopsidæ.
		Haplochitonidæ.
		Galaxiidæ.
		Osteoglossidæ.
		Notopteridæ.
Halosauridæ		
Chauliodontidæ		
Sternoptychidæ		

TELEOSTEI—Continued.

Marine.	Brackish.	Fresh.
Stomiatidæ		
Scopelidæ		
Aulopidæ		
Synodontidæ		
Microstomidæ		Microstomidæ.
Salmonidæ	Salmonidæ	Salmonidæ.
Salangidæ	Salangidæ	
Alepidosauridæ		
Paralepididæ		
Alepocephalidæ		
Gonorhynchidæ		
		Hyodontidæ.
Albulidæ		
Elopidæ	Elopidæ	Elopidæ.
Chanoidæ		
Dussumieridæ		
Clupeidæ	Clupeidæ	Clupeidæ.
Dorosomidæ	Dorosomidæ	Dorosomidæ.
Engraulididæ		
Chirocentridæ		
		Catastomidæ.
		Cyprinidæ.
		Cobitidæ.
		Homalopteridæ.
		Kneriidæ.
		Sternopygidæ.
		Electrophoridæ.
		Mormyridæ.
		Gymnarchidæ.
		Hypophthalmidæ.
		Trichomycteridæ.
Siluridæ	Siluridæ	Siluridæ.
		Chacidæ.
Plotosidæ	Plotosidæ	Plotosidæ.
		Clariidæ.
		Callichthyidæ.
		Argiidæ.
		Loricariidæ.
		Sisoridæ.
		Aspredinidæ.
		Monopteridæ.
		Symbrachidæ.
		Amphipnoidæ.
Murænesocidæ		
Congridæ		
Anguillidæ	Anguillidæ	Anguillidæ.
Rataburidæ		
Murænidæ		
Chilobranchidæ		
Nemichthyidæ		
Synapobranchidæ		
Saccopharyngidæ		
		Mastacembelidæ.
Notacanthidæ		

GANOIDEI.

Marine.	Brackish.	Fresh.
		Amiidæ.
		Lepidosteidæ.
		Polypteridæ.
		Lepidosirenidæ.
		Ceratodontidæ.
		Polyodontidæ.
Acipenseridæ	Acipenseridæ	Acipenseridæ.

ELASMOBRANCHII.

Marine.	Brackish.	Fresh.
Chimæridæ		
Myliobatidæ		
Cephalopteridæ		
Trygonidæ	Trygonidæ	Trygonidæ.
Torpedinidæ		
Raiidæ	Raiidæ	Raiidæ.
Rhinobatidæ		
Rhamphobatidæ		
Pristidæ	Pristidæ	Pristidæ.
Squatinidæ		
Heterodontidæ		
Notidanidæ		
Rhinodontidæ		
Cetorhinidæ		
Lamnidæ		
Odontaspididæ		
Alopeciidæ		
Sphyrnidæ		
Galeorhinidæ	Galeorhinidæ	Galeorhinidæ.
Scylliidæ		
Ginglymostomatidæ		
Crossorhinidæ		
Spinacidæ		
Scymnidæ		
Oxynotidæ		
Pristiophoridæ		

The following remarks apply only to those families which have representatives in more than one of the three kinds of aquatic habitat which are indicated in the foregoing table. The presence of the name of a family in only one of the three columns is alone a complete expression of the fact that no representative of it is known in any other habitat than the one thus indicated. It must be remembered, however, that almost any fish whose habitat ranges along the seacoast may occasionally run up into brackish water. Consequently the families enumerated under the head of "brackish" are such only as have representatives habitually living in brackish waters.

Although the Tetrodontidæ are a typically marine family, one species of it is known in South American fresh waters.

Most of the Syngnathidæ inhabit marine waters, but some of them range into estuaries, and a few are found in fresh waters.

As a rule the Soleidæ are marine fishes, but representatives of the family are known in South American and other fresh waters.

The Pleuronectidæ are also typically marine, but some species range into estuaries, and some of these range into adjacent fresh waters.

The Brotulidæ are mainly marine, many being found in abyssal depths; but two blind species, representing two genera, are found in the fresh waters of Cuban caves.

The Gadidæ, with the known exception of only one species, are marine fishes. This species is common to Europe and North America and is confined to fresh waters.

One species of the Blenniidæ in Europe inhabits fresh waters. Most of the known representatives of the family are marine, but some, especially in Australia, range into estuaries and fresh water.

Three South American species of the Batrachidæ range from marine and brackish into fresh waters. Almost all other known members of the family are denizens of marine waters.

The greater part of the Gobiidæ inhabit marine waters exclusively, but several species range into estuaries and adjacent fresh waters. Some species are confined to fresh waters.

A majority of the Cottidæ are confined to marine waters, but certain genera are of exclusively fresh-water habitat.

The Cichlidæ are a typically fresh-water family, but one genus usually referred to it is found in marine and estuarine waters.

The Embiotocidæ are mostly marine, but one genus is confined to fresh waters.

Most of the Gerridæ are of exclusively marine habitat, but some species range into estuaries and some even into adjacent fresh waters.

The Polynemidæ are typically marine, but some species range into estuaries.

The Sciænidæ are mainly of estuarine habitat; some range into fresh waters, and one North American genus is confined to fresh waters.

The Pristipomatidæ are mostly marine fishes, but certain Australian forms are known to range into brackish and fresh waters.

The Serranidæ are also mostly marine fishes, but some species occur in brackish waters, and a few North American forms live almost exclusively in fresh waters.

The Percidæ are a fresh-water family, but some species range down into mildly brackish waters.

Most of the Centropomidæ are denizens of marine waters, but some species find a congenial habitat in estuarine, and even in adjacent fresh waters.

The Atherinidæ are mainly marine, but some range into fresh waters, and one genus is confined to fresh waters.

The Mugilidæ are mostly of marine habitat, but some range into estuaries, and several species are confined to fresh water.

Some of the Gasterosteidæ are confined to marine waters and others to fresh. Most species are found in brackish waters.

The Belonidæ are mostly marine, some of them ranging into estuaries and even into fresh water. One genus is of exclusively fresh-water habitat.

The Scomberesocidæ are also mostly marine, some ranging into estuaries and even into the adjacent fresh waters.

The Cyprinodontidæ are mainly fresh-water fishes, but some range into estuaries and some are denizens of salt waters.

The Microstomidæ are mainly marine, but one species occurs also in fresh waters.

Some of the Salmonidæ have an exclusively fresh-water habitat, never migrating to salt waters. A large proportion of them migrate from marine to fresh waters for reproduction, but none of the family is wholly confined to marine waters.

The Salangidæ are typically marine, but some range into estuaries.

The Elopidæ are mostly marine, but some range into estuaries, and one species is found in the fresh waters of Lake Nicaragua.

Some of the Clupeidæ are confined to marine waters, and at least one species is known only in fresh waters. A large proportion of them, however, range from marine into fresh waters for reproduction.

The range of habitat of the Dorosomidæ is similar to that of the Clupeidæ.

The Siluridæ are mainly denizens of fresh waters, but one section of the family is confined to marine waters.

The Plotosidæ are mostly marine, but some species range into brackish waters and in some cases into fresh waters also.

The Anguillidæ all range from marine to fresh waters, returning to marine waters for reproduction.

The Acipenseridæ are usually found in fresh waters, but some of them range down into estuaries and even into waters of full marine saltness.

The Trygonidæ are mainly confined to marine waters, but one section of the family is peculiar to South American fresh waters.

The Raiidæ are almost exclusively of marine habitat, but some range into estuaries, and they have occasionally been found in waters that are nearly or quite fresh.

All the Pristidæ, with very few known exceptions, are confined to marine waters. One species is found in the fresh waters of Lake Nicaragua and another in the Philippine islands ranges from marine into fresh waters.

One species of the Galeorhinidæ is also found in Lake Nicaragua and another ranges from marine to fresh waters in the Philippine islands. All other known species are confined to marine waters.

Of the thirty-nine families mentioned in the foregoing notes as having representatives in more than one of the three kinds of habitat designated in the table, 28 of them are so generally confined to marine waters that geologists usually regard the discovery of remains of similar fishes in any given geological formation as evidence of its marine origin. Still, members of certain of these families present remarkable exceptions to the general rule thus indicated; such, for example, as the presence of Selachians in Lake Nicaragua and other fresh waters. Therefore, in case the fossils associated with such fish remains should distinctly indicate the fresh-water origin of the strata containing them, their presence may be held as not necessarily constituting conflicting evidence because of the known exceptions to the rule that their living congeners have a marine habitat.

Of the remaining eleven families mentioned in the foregoing notes three are more abundantly represented in fresh than in saline waters. To these the converse of the foregoing remarks will apply. Because of the varying range of habitat of the remaining eight families mentioned in the foregoing notes the discovery of remains referable to any of them in a given formation would be of little value as evidence in determining the character of the water in which it was deposited unless supported by other and more definite evidence.

The Marsipobranchii and Leptocardii are by some authors included in the class of fishes proper, but Dr. Gill and others regard them as separate classes coördinate with fishes, reptiles, etc.

Two of the three families belonging to the Marsipobranchii are known only in marine waters. Most of the members of the other family, namely, the Petromyzontidæ, range from marine into brackish and fresh waters, as is well known in the case of the lampreys.

No representation of the Leptocardii are known in other than marine waters.

This review of the fishes is confined to those families which have living representatives, and the criteria relating to the different kinds of aquatic habitat of fossil fishes which may be based upon this review apply directly only to the families here named.

Fossil remains of a large number of kinds of fishes have been discovered, especially in the paleozoic formations, which differ so much from all living kinds that they can be referred to no family, and sometimes to no order, which has living representatives.

The character of the water in which such fishes lived might be conjectured by reference to their most nearly related forms, but the most reliable indication is furnished by such other fossil remains as may be found associated with them.

MOLLUSCA.*

The Mollusca are of peculiar importance in connection with the subject of this review, because the greater part of the members of this subkingdom have aqueous respiration, and because in the matter of distinguishing marine from nonmarine formations and the latter from one another it is with their often abundant fossil remains that the geologist has more frequently to deal than with those of any other animals.

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* The classification of the Mollusca used in this review is that of Dr. Theodore Gill's "Arrangement of the Families of Mollusks." See Smithsonian Miscellaneous Publications, No. 227, 1871.

Cephalopoda.—Every known member of all the families of this class is exclusively marine, therefore the presence of fossil remains referable to any member of the class in any formation is regarded as sufficient evidence of its marine origin, provided that its character and condition indicate that the animals thus represented were denizens of the waters in which the formation was deposited.

Gasteropoda.—The following table, constructed upon the same plan as that of the fishes, is intended to give a synoptical view of the aquatic habitat of each of the families of living gasteropods which have direct relation to the subject of this review. For obvious reasons all those families are omitted which include only air-breathers as well as those families all the members of which possess no shell, either internal or external. As in the case of the preceding table, this one is followed by explanatory notes setting forth certain facts which are not clearly expressed by means of such a tabular arrangement:

Diœca.

ORDER PECTINIBRANCHIATA.

Marine.	Brackish.	Fresh.
Conidæ		
Pleurotomidæ		
Melatomidæ		
Haliidæ		
Terebridæ		
Cancellariidæ		
Admetidæ		
Cystiscidæ		
Marginellidæ		
Volutidæ		
Fasciolariidæ		
Mitridæ		
Melongenidæ		
Buccinidæ	Buccinidæ	Buccinidæ.
Nassidæ	Nassidæ	
Cynodontidæ		
Turbinellidæ		
Turridæ		
Olividæ		
Harpidæ		
Ptychatractidæ		
Muricidæ		
Columbellidæ		
		Ampullariidæ.
		Valvatidæ.
		Viviparidæ.
	Assiminiidæ	Assiminiidæ.
Rissoellidæ		
		Pomatiopsidæ.

Diœca—Continued.

ORDER PECTINIBRANCHIATA—Continued.

Marine.	Brackish.	Fresh.
Rissoidæ	Rissoidæ	Rissoidæ.
Skeneidæ		
		Bythiniidæ.
Fossaridæ		
Littorinidæ	Littorinidæ	
Pyramidellidæ		
Eulimidæ		
Styliferidæ		
		Ceriphasiidæ.
	Melanopsidæ	Melanopsidæ.
		Melaniidæ.
Cerithiopsidæ		
Cerithiidæ	Cerithiidæ	Cerithiidæ.
Planaxidæ		
Cæcidæ		
Vermetidæ		
Tenagodidæ		
Turritellidæ		
Trichotropidæ		
Hipponicidæ		
Capulidæ		
Calyptreidæ		
Neritopsidæ		
Onustidæ		
Strombidæ		
Aporrhaidæ		
Pediculariidæ		
Amphiperasidæ		
Cypræidæ		
Triviidæ		
Marseniidæ		
Velutinidæ		
Naticidæ		
Pyrulidæ		
Doliidæ		
Cassididæ		
Ranellidæ		
Tritonidæ		
Ianthinidæ		
Solariidæ		
Scalariidæ		

ORDER HETEROPODA.

Marine.	Brackish.	Fresh.
Atlantidæ		
Carinariidæ		
Pterotrachæidæ		

ORDER RHIPHIDOGLOSSA.

Marine.	Brackish.	Fresh.
Neritidæ	Neritidæ	Neritidæ.
Rotellidæ		
Rotellidæ		

Diæca—Continued.

ORDER RHIPHIDOGLOSSA—Continued.

Marine.	Brackish.	Fresh
Turbinidæ		
Liotiidæ		
Trochidæ		
Stomatellidæ		
Pleurotomariidæ		
Scissurellidæ		
Haliotidæ		
Fissurellidæ		
Emarginulidæ		

ORDER DOCOGLOSSA.

Acmæidæ	Acmæidæ	Acmæidæ.
Patellidæ		
Lepetidæ		

ORDER POLYPLACOPHORA.

Chitonidæ		
Chitonellidæ		

Pulmonifera.

ORDER PULMONATA.

		Chilinidæ.
		Physidæ.
		Ancylidæ.
		Limnæidæ.
Otinidæ	Otinidæ	
Auriculidæ	Auriculidæ	
Siphonariidæ	Siphonariidæ	
Gadiniidæ	Gadiniidæ	
Amphibolidæ	Amphibolidæ	

Opisthobranchiata.

ORDER TECTIBRANCHIATA.

Philinidæ		
Amphyspiridæ		
Ringiculidæ		
Actæonidæ		
Cylinchnidæ		
Bullidæ		
Amplustridæ		
Lophocercidæ		
Aplysiidæ		
Runcinidæ		
Tylodinidæ		
Umbrellidæ		
Pleurobranchiidæ:		

Pteropoda.

ORDER THECOSOMATA.

Marine.	Brackish.	Fresh.
Limacinidæ		
Hyalidæ		
Cymbuliidæ		

Prosocephala.

ORDER SOLENOCONCHÆ.

Dentiliidæ		

The foregoing table of the families of living Gasteropoda is, as already stated, constructed upon the same plan as that of the fishes, an explanation of which plan and its significance is given on page 336. The list includes the names of only those families at least some members of which possess shelly or skeletal parts that are likely to resist decomposition after the death ot the animal. Other families are not included, because it is only by means of those hard parts that the living can be compared with fossil forms. The significance of placing the name of a family in only one of the three columns of the table is so apparent as to need little, if any, explanation, but there are certain facts relating to members of others of these families which such a table can not distinctly show. Mention of such of these and kindred facts as is deemed necessary for the present purpose is made in the following supplementary notes.

The greater part of the Buccinidæ inhabit marine waters, but they not unfrequently range into estuaries, and certain species are sometimes found in waters that are nearly or quite fresh.

While a majority of the species of the Assiminiidæ find a fresh-water habitat congenial, some live upon the borders of saline water, at river mouths or in estuaries.

Of the living forms referable to the Rissoidæ some inhabit marine, some brackish, and others fresh waters, but no species is known to range from one of these kinds of habitat into another, although it is probable that some may do so. Because the fossil species referable to this family may, as a rule, be regarded as distinct from all living species, the presence of fossil shells referable to this family in any formation does not necessarily give any definite indication as to whether it was of marine, brackish, or fresh water origin. In such cases the character of the habitat must be determined by means of their faunal associates.

The Littorinidæ usually inhabit the margins of marine waters, but some species have a brackish-water habitat.

The Melanopsidæ usually inhabit fresh waters, but some of them are ound in waters that are more or less saline.

All living forms of the Melaniidæ are regarded as fresh-water mollusks, but a few species appear to be able to live in waters which are in some degree saline. Certain fossil members of this family have been found in such association with other molluscan remains as to indicate that they were capable of living in saline waters.

Much the greater part of the Cerithiidæ inhabit marine waters, but some species are known to find a congenial habitat in brackish waters, and a few are known to range into adjacent fresh waters.

As a rule, the Neritidæ are found in either marine or brackish waters, but a few species are known to live in fresh water.

The Trochus-like shells which have been found in Lake Tanganyika probably do not belong to the Trochidæ. The trochids are therefore regarded as distinctly marine.

A few of the Acmæid limpets found in Borneo are reported to pass from saline waters into fresh. The Acmæidæ are not uncommon in brackish waters, but members of the family are most abundant in marine waters.

The Otinidæ, Auriculidæ, Siphonariidæ, and Gadinidæ, are air-breathing mollusks living upon the margins of both marine and brackish waters. The Amphibolidæ also usually inhabit the sea margin, but some of them appear to find waters of less than marine saltness not uncongenial.

Although the Bullidæ are, as a rule, strictly marine, two genera, namely, Haminea and Tornatella, have been found in the mud of brackish water lagoons.

As indicated in the paragraph preceding this table, all the members of the Gasteropod order Nudibranchiata, together with all those of the Pteropod order Gymnosomata are omitted from it because none of the species possess more than a minute embryonic shell, and therefore no identifiable fossil remains of any members of these orders are likely to be discovered. All the Tunicata and land Pulmonata also are omitted, the former because the character of the body is always such that remains of it are not likely to be found fossilized, and the latter, because they have no direct relation to an aquatic habitat.

Of the twelve families mentioned in the foregoing notes as having representatives in more than one of the three kinds of habitat indicated in the table, fully one-half of them are so generally found only in marine waters that geologists usually are inclined, in the absence of contrary evidence, to regard fossil representatives of them as indicating a marine origin for the strata in which they may occur. Three of the other families are so generally found only in fresh waters that the converse of the foregoing remarks would apply to them. Representatives of the others are so often found in both marine and nonmarine waters that in the case of fossil representatives it is always necessary to have corroborative evidence as to the probable character of the water in which they lived.

Conchifera.—The following table of the families of the Conchifera is constructed in the same form as that of the Gasteropoda, and the general remarks preceding that table are applicable to this:

ORDER DIMYARIA.

Marine.	Brackish.	Fresh.
Aspergillidæ		
Gastrochænidæ		
Teredinidæ	Teredinidæ	Teredinidæ.
Pholadidæ		
Solenidæ		
Solecurtidæ	Solecurtidæ	Solecurtidæ.
Saxicavidæ		
Myidæ		
Corbulidæ	Corbulidæ	Corbulidæ.
Pandoridæ		
Anatinidæ		
Myochamidæ		
Pholadomyidæ		
Mactridæ		
Mesodesmidæ		
Amphidesmidæ		
Tellinidæ		
Psammobiidæ	Psammobiidæ	
Donacidæ		
Petricolidæ		
Veneridæ		
Glauconomidæ	Glauconomidæ	
Cyrenidæ	Cyrenidæ	Cyrenidæ.
		Pisidiidæ.
Cyrenoididæ	Cyrenoididæ	Cyrenoididæ.
Dreissenidæ	Dreissenidæ	Dreissenidæ.
Veniliidæ		
Glossidæ		
Cardiidæ		
	Adacnidæ	Adacnidæ.
Chamidæ		
Lucinidæ		
Ungulinidæ		
Erycinidæ		
Cyamiidæ		
Leptonidæ		
Galeommidæ		
Solemyidæ		
Crassatellidæ		
Carditidæ		
		Unionidæ.
		Iridinidæ.
		Mycetopodidæ.
		Ætheriidæ.
		Muelleriidæ.
Trigonidiæ		
Nuculidæ		
Ledidæ		
Arcidæ	Arcidæ	Arcidæ

ORDER METARRHIPTÆ.

Marine.	Brackish.	Fresh.
Tridacnidæ		

ORDER HETEROMYARIA.

Mytilidæ	Mytilidæ	

ORDER MONOMYARIA.

Pinnidæ		
Pteriidæ		
Vulsellidæ		
Spondylidæ		
Limidæ		
Pectinidæ		
Placunidæ		
Anomiidæ	Anomiidæ	
Ostreidæ	Ostreidæ	

The following remarks are confined to those families which are known to have representatives in more than one of the three kinds of aquatic habitat indicated in the foregoing table.

The Teredinidæ are properly regarded as a marine family, but at least one living species is known in a fresh-water habitat, namely, in the lower Ganges. Therefore the discovery of a fossil member of this family is not of itself positive, although presumptive, proof of the marine origin of the formation containing it.

A similar remark may be made concerning the Solecurtidæ, a few species of which have been found in brackish waters, and in rare cases some have been known to range into fresh waters.

The Corbulidæ are common in both marine and brackish waters, and they are occasionally found to have passed into adjacent fresh waters or to have survived the freshening of the saline waters in which they formerly lived. Fossil members of this family are often found with only marine associates, quite as often with brackish water associates, and in rare cases all associated species are fresh-water forms.

Some species of both the Psammobiidæ and Glauconomidæ have been found in estuarine waters of considerably less than marine saltness. Therefore fossil species referable to either of these families are likely to be found associated with an estuarine fauna.

The Cyrenidæ like the Corbulidæ, are represented in marine, brackish, and purely fresh waters, and the paleontological significance of both families is similar.

The range of habitat of the Cyrenoididæ is similar to that of the Cyrenidæ, except that none of them are known to inhabit purely fresh waters.

The Dreissenidæ as a family appear to find marine, brackish, and fresh waters equally congenial, and some species appear to range into both brackish and fresh water. This family, however, is represented by a greater number of species in nonmarine than in marine waters.

The Adacnidæ are seldom or never found in waters of full marine saltness, but they are found in such waters as those of the fresher portions of the Black sea, in estuarine waters, and in those which are quite fresh. Therefore fossil members of this family are regarded as indicating a nonmarine origin for the deposits containing them.

One feels so fully warranted in regarding the living Arcidæ as a marine family that he expects to find no exception among its fossil members, but the case of the living fresh-water *Scaphula gangetica* shows that this rule is not absolute. Therefore it is possible, if not probable, that fossil members of this family may be discovered in nonmarine formations.

While the Mytilidæ all thrive in waters of full marine saltness, some of them also thrive in brackish waters. Entirely fresh waters, however, seem to be uncongenial to all of them.

All the Ostreidæ thrive in waters of full marine saltness. They thrive equally well in the less saline waters of estuaries and bays, but never in entirely fresh waters. Therefore the presence of fossil representatives of this family in any formation is taken to indicate that the water in which it was deposited was at least in some degree saline.

The Anomiidæ are far more abundant in marine than in any other waters, but they are frequently found in the less saline waters of bays and lagoons. They are not known to occur in fresh waters, and it is therefore inferred that no fossil members of this family had a fresh-water habitat.

Brachiopoda.—Every known member of all the families of this class is exclusively marine. Therefore geologists regard the presence in any formation of Brachiopod remains as sufficient evidence of its marine origin, in case there is no indication of its accidental presence.

Polyzoa.—With the exception of the three fresh-water families, Pectinatellidæ, Cristatellidæ, and Plumatellidæ, all the Polyzoa inhabit saline waters, most of them living in those of full marine saltness. A few of them range into brackish waters, but as a class they are so generally marine in their habits that the geologist rarely hesitates to conclude that any formation is of marine origin which contains fossil polyzoan remains. This conclusion is supported by the fact that the living fresh-water representatives of the class are rarely provided with skeletal, protective, or supporting parts which resist decomposition after the death of the colonies of minute animals.

ANNULOIDA.

The Annuloida are divisible into two classes, the Scolecida and Echinodermata. All the Scolecida are omitted from this review because the remains of no representative of any of its families is likely to be discovered in a fossil state.

Every known member of all the families of the class Echinodermata is a denizen of marine waters. Therefore the discovery in any formation of fossil remains referable to this class is accepted as proof of its marine origin.

ANNULOSA.

The classes Myriapoda and Arachnida are omitted from this review because they are all land animals except the few that find a congenial habitat in more or less direct contact with water.

In their adult state the Insecta are generally land animals, but some of them resort to at least a partially aquatic habitat. In their larval state, however, many insects are true aquatic animals, usually living in fresh waters. In this state some of them possess no such skeletal or protective parts as are likely to resist decomposition, but many of them, like the adult Insecta, Arachnida and Myriapoda, are provided with a chitinous covering which retains more or less completely the bodily form of the animal after its death and decomposition. Therefore such forms are not unfrequently found preserved in a fossil state, but because all, or nearly all the members of those three classes had either a land or fresh-water habitat their remains are much more likely to find intombment in the sediments of fresh waters than in those of either brackish or marine waters. Indeed no such remains are known to have been found in any deposits which are unmistakably of marine origin.

Crustacea.—All the Crustacea being provided with gills or other organs suited to aqueous respiration have a peculiarly direct relation to the subject of these discussions. All of them also being provided with a more or less complete dermal skeleton or outer covering which resists decomposition and retains the form of the animal after its death, necessarily are of great paleontological importance. It is, however, true that their practical value in the present discussion is much less than that of the Mollusca not because of any inferiority, but because crustacean remains are comparatively very rare, especially in all North American strata which represent that portion of geological time during which were deposited the principal unmistakably nonmarine formations. For this and other reasons a tabulation of the families of the living Crustacea like that of the fishes and mollusks on preceding pages has been omitted. Some of the more important facts concerning the range of habitat of certain of the various groups which constitute this class are, however, recorded in the following paragraphs.

This review of the Crustacea is, therefore, somewhat more general than that of the fishes and mollusks. That is, no regular classification of the Crustacea is attempted, but the remarks are ranged under the head of the general divisions of the class, and direct reference is made only to those families or other subdivisions representatives of which are found in either fresh or brackish waters or both. All those subdivisions, which are not specially mentioned, are not known to live in other than marine waters.

Members of many of the families of the large subclass Malacostraca range beyond the limits of marine waters, but most of them are confined to a marine habitat.

The living Brachyurans are so generally of marine habitat that in the absence of any conflicting evidence geologists are usually disposed to regard all those strata as of marine origin which contain fossil remains referable to this division of the Crustacea, but the following facts show that this exclusive view is not admissible. The greater part, if not all of one subfamily, the Thelphusinia, are either denizens of fresh waters or live a large part of the time upon the land in the vicinity of fresh waters. Some species of the Grapsoidea, although most of them are marine, also have a similar range and peculiarity of habitat while others are apparently confined to brackish waters. Many of the marine as well as of the fresh-water species of the Grapsoidea range more or less upon the land.

Although it is well to emphasize the fact that most of the species and genera of the Brachyurans are typically marine animals, many of them besides those already referred to, such, for example, as the genera Callinectes and Panopeus, range into estuaries and bays, some of them going into adjacent fresh waters without apparent inconvenience. It is also a significant fact that of the Brachyurans, as well as of the Macrurans which inhabit fresh waters, many more are found in fluviatile and palustral than in lacustrine waters.

The range of habitat of the Anomoura is similar to that of the Brachyura. Most of them live in waters of full marine saltness, some inhabit brackish waters, some wander inland, and one genus, Æglea, is nearly or quite confined to fresh waters. It is thus apparent that the discovery of fossil remains of a representative of this group of Crustaceans in a given formation would not necessarily be proof of its marine origin.

The Macrura as a whole have a wide range of aquatic habitat, most of them living in marine waters, many in fresh waters, and some of them venturing occasionally upon the land.

The family Astacidæ proper, or crayfish, are all denizens of fresh water, while those similar genera which were formerly referred to this family are confined to a marine habitat, with the probable exception that some of them range into brackish waters. Although many of the Astacidæ burrow in wet earth at considerable distances from any body of water, few or none of them wander so far upon the land as do some of the Brachyura or even some of the Anomoura.

The Crangonidæ are generally of marine habitat, but some range into brackish waters.

Most if not all the Atyidæ inhabit fresh waters.

Many of the Palæmonidæ are restricted to marine waters, many live in brackish waters, and several genera are confined to fresh waters, some of them living in rivers far from the sea.

As a rule the Penæidæ inhabit marine waters, but some of the species are known to range into fluviatile waters.

The Stomatopoda have considerable range of habitat. Some of the Mysidæ range from marine into brackish waters, and at least one species is found in inland fresh waters.

The Squillidæ are, as a rule, marine forms, but some of them range into brackish waters.

The greater part of the Isopoda inhabit marine waters, but many genera are confined to fresh waters, while all the members of one family, the Oniscidæ, are of terrestrial habitat. A considerable number of genera also range into brackish water.

All known members of the Anisopoda are denizens of marine waters.

A considerable proportion of the species and many genera of the Amphipoda are denizens of fresh water while most of the others are confined to a marine habitat, many ranging into brackish waters.

The subclass Entomostraca embraces a greater proportion of denizens of nonmarine waters than does the subclass Malacostraca. They are also of special interest to the geologist because representatives of at least one suborder are found in much earlier formations than are any members of the other subclass.

The Cirripedia are so generally regarded by geologists as being exclusively denizens of marine waters, or of those which are of nearly full marine saltness, that they rarely hesitate to accept the presence of fossil remains of any crustacean referable to this order in any formation as evidence of its marine origin. One species of Balanus, however, has been found in comparative abundance ranging from marine waters far up the St. John's river in Florida, and thriving there in fresh water. This case is apparently as exceptional as that, for example, of the Teredinoid and Arcoid mollusks in the lower Ganges and of Selachian fishes in Lake Nicaragua, but it may be that other similar cases will be found among the Cirripedia. Still, in the absence of conflicting evidence geologists are probably justified in regarding Cirriped remains as indicating marine conditions.

The Copepoda are mostly minute animals, and inhabit both fresh and salt waters. They are usually provided with a chitinous or membranous covering which, with few exceptions, is too delicate to be well preserved in sediments after the death of the animal. It is probable, therefore, that few fossil remains of these animals have ever become fossilized, and these are likely to escape discovery because of their minuteness and delicacy.

Various forms of the bivalve Crustacea constituting the Ostracoda are found in both fresh and marine waters, and also in the brackish water of estuaries. They are often gregarious, immense numbers being often found together. Their former abundance was also great, as is shown by the multitudes of fossil forms that are sometimes found in the sedimentary rocks of various ages.

Most of the Phyllopoda inhabit fresh waters, but some live in marine, and some in brackish waters. They are mostly small or minute Crustaceans but being gregarious they are often found together in great numbers. Their paleontological value is similar to that of the Ostracoda except that the latter are more prevalent in the paleozoic formations.

Nearly or quite all the Crustacea of the earlier geological ages are referable to the subclass Gigantostraca, but its living representatives are only the Xiphosura, and these are confined to two species of the genus Limulus. Although the Malacostraca are more conspicuously abundant than all other living Crustaceans, fossil remains referable to any divisions of this subclass are comparatively rare in strata of any age and none have been found in rocks of earlier than Carboniferous age. On the contrary, the Gigantostraca, which are represented by only two known living species, existed in great abundance in the Cambrian, Silurian and Devonian ages, when they were represented by numerous genera and families, especially of the trilobites.

It is therefore evident that a knowledge of the different kinds of aquatic habitat of living crustaceans affords little direct information concerning that of those which lived during the three earlier geological ages just mentioned. Consequently all the obtainable evidence of this kind is derived from the remains of their faunal associates. Much the greater proportion of all those ancient crustaceans, including all of the trilobites, are thus assumed to have lived in marine waters, but the usual absence of immediately associated forms that can be with certainty assigned to either a marine or nonmarine origin has left in doubt the question as to the character of the water in which others of the Gigantostraca lived.

Annelida.—The members of this class which possess such skeletal or protective parts as are most likely to resist decomposition are the Tubicola, all of which secrete a shell, usually calcareous, much resembling the shells of gasteropod mollusks. They are all denizens of saline waters, mostly those of the open ocean. By means of the partly chitinous covering of certain of the Errantia or roving worms, their bodily form may occasionally be preserved after the death of the animal in the sediments which formed its habitat while living; and their presence in such sediments is often indicated by their burrows when the animals themselves are not discovered.

So generally are the Annelida denizens of marine waters that the presence of the remains or burrows of any of them in a geological formation is regarded by geologists as indicating its marine origin.

CŒLENTERATA.

The Hydrozoa only of the somewhat numerous orders embraced in this subkingdom are represented in fresh waters. These fresh-water presentatives are all minute, and are not furnished with skeletal parts such as would be likely to be preserved in a fossil state. Therefore it is not to be expected that fossil remains referable to the Cœlenterata will be found in any formation of fresh-water origin.

The marine subclasses Siphonophora, Discophora, and Lucernarida, as well as many members of the class Actinozoa, are also all destitute of such skeletal parts as are likely to long resist decomposition after the death of the animal. It is an interesting fact that unmistakable imprints of the bodies of Cœlenterata belonging or related to the jelly-fishes have been found in certain geological strata composed of extremely fine sediments; but, as a rule, the geologists can not hope to discover any fossil traces of animals which in life were not furnished with such skeletal or integumentary parts as would resist the decomposition of their soft parts after death. While the bodies of many of the Cœlenterata are wholly of this soft character, a large proportion of them are furnished with stony skeletal parts, the most conspicuous examples of which are the numerous kinds of corals. Others are furnished with corneous or chitinous coverings or supports which are sometimes found fossilized. So characteristic are these Actinozoa of marine waters that the geologist does not hesitate to accept as of marine origin any formation containing fossil corals, which are the skeletal parts of such animals.

PROTOZOA.

Of the Protozoa only the orders Foraminifera, Radiolaria, and Spongida need be mentioned in this review, because only representatives of these orders secrete such hard parts as are likely to be preserved in a fossil state. Much the greater portion of the Protozoa are microscopically minute, but the sponges and some other forms are frequently of large size. The Protozoa live in both fresh and marine waters, but they are so very much more abundant in the latter that the discovery of their remains in a geological formation is usually taken as indicating its marine origin.

PLANTS.

Compared with the fossil remains of animals very little direct information can be obtained from those of plants as to the character of the water in which the formations containing them were deposited.

The siliceous remains of diatoms often constitute layers of considerable thickness among the sedimentary rocks, but because they are found in both marine and nonmarine deposits, and because of the special character of their classification, they are not definitely referred to in these discussions.

All seaweeds or marine plants are far more simple in structure than land plants and their composition is such as to insure their rapid decomposition. This character has prevented their fossilization in the sediments of formerly existing seas in such a condition as to be of any considerable value in paleontological study. The case is somewhat different as regards palustral plants, the character of most of which may usually be accepted as trustworthy evidence of their nonmarine habitat. Still, the remains of land plants, like those of land animals, are far more likely to have found the quiet entombment necessary to their preservation in the sediments of nonmarine than in those of marine waters, because the former waters were surrounded by the land upon which the plants grew, and because the nonmarine sediments receiving such remains are, as a rule, not subject to the destructive littoral wash which usually prevails along sea borders.

The following facts and assumptions have a direct bearing upon the foregoing statements and discussions and upon their practical application to geological investigation.

The various bodies of water which existed during geological time, and which constituted the habitat of aquatic animals, were of the same kinds that now exist, namely, marine and fresh, together with those of the various intervening grades of saltness. Although it is probable that the marine waters of early geological time were not so salt as those of the present oceans, it is believed that this difference in saltness has not been so great as to make any appreciable difference as to legitimate conclusions of the kind that have been indicated on preceding pages. It seems to be especially evident that this difference has been thus inappreciable since the close of paleozoic time, since which time the greater part of the known unmistakably nonmarine formations were deposited.

Existing bodies of water are constantly depositing materials similar to those of which the sedimentary rocks are composed.

In past geological epochs the habits of animals of a given character and structure were the same as those of similar now living animals, and they lived under conditions similar to those which are congenial and necessary to their now living congeners. Also in those epochs plants of a given character lived under conditions similar to those which are necessary to the corresponding kinds of now living plants.

Those animals alone which are furnished with organs for aqueous respiration can be confidently relied upon as indicating the character of the water in which they respectively lived.

Thus, if all the known now living members of a given family are confined to marine, or to fresh waters, as the case may be, it is assumed that the habitat of the extinct members of such families were similarly restricted, and that the presence of fossil remains of such animals in a given formation is, in the absence of conflicting facts, sufficient evidence of its marine origin on the one hand or of its fresh-water origin on the other. Again, if a given family is known to have representatives now living in marine, brackish, and fresh waters, respectively, it is assumed that it had a similar range of habitat during past geological epochs. Therefore, the discovery in a given formation of fossil remains of a single representative of a family having such a varied range of habitat is not of itself sufficient to enable one to decide whether it was of marine, brackish, or fresh water origin, and other evidence must be sought.

The evidence upon which criteria of the character of formerly existing bodies of water are based is usually more or less direct, but it is sometimes cumulative and concurrent in its character. Still, when properly applied, the latter kind of evidence is usually nearly or quite as valuable as if it were absolute and direct.

The criteria of past aqueous conditions which are discussed in this essay are of course only such as may be derived from sedimentary formations and their contents. It can not be said that there are any fully trustworthy physical criteria because a nonmarine formation rarely presents any condition of stratification, or any lithological character, which is not observable in some marine formations. Still, there are many more or less valuable indications which may be observed and to some degree relied upon in the absence of fossil remains.

For example, although considerable accumulations of calcareous strata are sometimes found among the generally arenaceous strata of fresh-water formations they have never been found to contain any important accumulations of regularly bedded limestones. Furthermore, estuarine deposits are often still more of a detrital character than are fresh-water formations and also they more rarely contain calcareous layers. Therefore if one should encounter a series of regularly bedded limestones, either magnesian or fully calcareous, he will rarely, if ever, be at fault in regarding them as of marine origin even without biological evidence.

In a large proportion of the nonmarine formations the stratification is less regular than is usually the case with marine formations. Still, this by no means is a certain criterion, and in some cases nonmarine formations are found to rest so conformably upon the marine and to be so conformably overlain by them as to give little indication of the great difference in the condition of their origin.

The foregoing examples show how indefinite is the character of physical evidence as to the past aqueous conditions under which the various sedimentary formations have been produced, but they serve to emphasize a statement of the fact that almost entire reliance must be placed upon the evidence furnished by fossil remains.

With reference to general indications of difference between marine and nonmarine formations which are furnished by their fossil remains we observe that a conspicuous difference lies in the comparative abundance and variety of forms of life which the fossil faunas of the formations respectively represent. Marine waters have always teemed with life in a wonderful variety of forms, and their fossil remains are proportionally abundant. The variety is less in brackish waters and least of all in lacustrine waters. It is true that ichthyic life is abundant in some fresh waters, but never so generally abundant or so various as in marine waters. It is also true that molluscan life is often locally abundant in shallow fresh waters, but, as already several times mentioned, the variety is extremely meager. All these peculiarities are distinctly observable among the fossil faunas of the nonmarine formations.

Other general indications of difference between marine and nonmarine formations are furnished by remains of land plants and animals. Open-sea formations are naturally free from any vegetal remains derived from the land, although coal and other materials of vegetal origin are not unfrequently found alternating with layers containing marine fossil remains. These, however, as explained on a preceding page, are regarded as cases of emergence of the bottom of shallow sea waters and the subsequent subsidence of the same as plant laden marshy land. It is a matter of fact, the reason for which has been suggested in preceding essays, that plant remains of any kind, especially such as are in a classifiable condition, have so rarely been found associated with remains of denizens of marine waters that the discovery of fossil plants in any formation is of itself presumptive evidence of its nonmarine origin.

It has already been shown on preceding pages that the remains of land animals have so seldom reached marine waters or, having reached them, they were probably so generally destroyed by the triturating action of coast waves that the discovery of any of this kind of fossil remains in any formation may also be regarded as presumptive evidence of its nonmarine origin.

The foregoing statements have been made with reference to indications which are either of a general character or without direct relation to the quality of the waters in which sedimentary formations have been deposited. All the direct evidence, as already has been fully stated, is derivable from the fossil remains of the denizens, especially the gill-bearing kinds, of the waters in which were deposited the formations under investigation.

Referring to the foregoing review of the animal kingdom, including the tables which it embraces, it will be seen that a large number of families of both fishes and invertebrates are confined to a marine habitat, and that every member of even some of the higher divisions is similarly restricted. For example, every known member of the classes Cephalopoda and Brachiopoda is confined to a marine habitat. It will also be seen that a certain small number of families, especially of the mollusca, are equally restricted to fresh waters. The significance of such cases as these has already been pointed out, but it is desirable to refer to them again.

Fossil remains representing any one of these kinds of animals may be taken as positive evidence of the quality of the water in which was deposited the formation containing them, provided there shall be no room for reasonable doubt that the animals were really denizens of that water. That is, caution is necessary even in these more positive cases, especially when the amount of discovered fossil material is meagre.

Not only caution but the exercise of careful judgment is necessary in other cases. For example, it will also be seen by referring to the foregoing review that certain families, while most of its members are confined to one kind of water, may have one or more representatives in other kinds, and again that certain families may have representatives in all the known kinds of habitable waters. In such cases as these it is plain that all evidence afforded by fossil remains to be of any value must be corroborated by other evidence.

Still, the cases are very few in which serious doubt need be entertained as to the true character of the water in which a given formation was deposited. This is especially true if the fossil remains are sufficient in quantity and perfection to approximately represent the whole fauna that lived in those waters. Indeed, if the facts which are recorded on the preceding pages are borne in mind there need be no more doubt as to what was the quality of the water in which any given formation was deposited than might arise concerning any other geological observation.

VIII. THE CLAIMS OF GEOLOGICAL SCIENCE UPON INVESTIGATORS, MUSEUMS, ETC.

With reference to the ordinary pursuits of life it can hardly be said that, aside from a natural demand for respectable emulation, one's occupation has any claims upon him other than those which are either conventionally or legally imposed by society upon every one of its members. The geological investigator, however, is not only amenable to all such claims but to others of a different nature which, although not enforceable by legal, and unfortunately not yet by conventional, penalties are not less imperative in their character.

These claims upon the investigator will be presented in the following paragraphs, but it is well to remark here that they are by no means an abridgement of his rights as an individual, because he has no rights with relation to science which the latter does not confer. It is true that the legal right of personal ownership of scientific material and the abstract right of independent investigation can not be questioned from the standpoint of the ordinary affairs of life, but it is my purpose to show that the individual investigator owes an allegiance to science which demands at least a modification of the privilege of asserting those rights. That is, I propose to show that because the general advancement of geological science must be accomplished and its integrity maintained by the coöperation of a multitude of workers in the various branches of investigation, its claims are superior to those of the individual, and that he can not exclusively assert the rights referred to without material disadvantage to science. Indeed, he can not do so without lessening, and to some extent destroying, the value of his own labors.

Much might be said in favor of the demands which may be made in the name of science upon the individual on the ground of justice and of moral and social ethics, but I shall omit all considerations of this kind and refer only to those claims which are supported by the urgent necessities of science itself. Claims of the kind referred to might be made in favor of all the various divisions of science, but I shall on the present occasion confine my discussions to those which pertain to biological geology, including both its structural and systematic branches. With reference to the manner in which the subject of this essay is presented it is proper to say that the homilitic form has not been adopted merely from personal preference, but because I believe it to be in the present case a proper and effective, if an indirect, method of calling attention to prevalent errors, and of suggesting necessary improvements in certain prevalent methods.

These claims of science will be considered not only with reference to the individual investigator, but to associations, museums, and geological organizations. Those which may be made upon the individual investigator relate to the manner of prosecuting his work and of publishing its results, and also to his final disposition of the evidence upon which his conclusions are based. Claims upon associations or societies relate to the character and methods of publication; those upon museums, to the conservation and installation of fossil remains and of the records pertaining to them; and those upon organizations, to the preservation of the integrity of geological science.

Among the necessities of geological science which require the enforcement of these claims are those which arise from its extensive range, the interrelation of its various branches, and the cumulative character of the evidence upon which it is based. Its extensive range makes it impossible that any one investigator should compass more than a small part of the whole field, the interrelation of its branches requires that each branch should be investigated with direct reference to all the others, and the cumulative character of the evidence which constitutes its foundation requires that every item of that evidence should be conventionally judged. These conditions show that it is the public and not the individual that must be the final arbiter of all questions pertaining to the results of investigation. It is, therefore, essential that the public should be furnished with all the evidence upon which the individual reaches his conclusions, and that this evidence should be so preserved as to be accessible to all investigators.

In all such arbitrations a clear distinction must necessarily be made between evidence and testimony. The former rests upon facts and is therefore intrinsically infallible. The latter rests only upon individual judgment and is in every case liable to be modified even by its authors, and to be questioned, if not opposed, by others. Facts observed and recorded, and material collected and preserved, constitute a perpetual source of evidence, but personal authority can have no permanently exclusive or dominant place with relation to geological science, and acceptable personal responsibility for published conclusions and announcements of discovery must be confined to those which are supported by tangible evidence and by reference to all obtainable fundamental and relevant facts.

In biological geology the principal evidence necessary to be obtained is of two kinds, biological material in the form of fossil remains, and stratigraphic conditions with relation to geological structure and general stratigraphic classification. The fossil remains must necessarily be collected for study, and science justly demands that they should be placed where they will ever after be accessible to all investigators. It is also essential that observations of stratigraphical conditions should be made in immediate connection with the collection of fossil remains, and that such observations and collections should in all cases be so recorded and published that every locality may be readily revisited and identified, and every observation repeated by any other observer.

In short, it is essential that the public should be furnished with the same means of judging of the significance of all the facts and conditions that may be reported by an original, or any other, observer that they have themselves employed. It is largely with reference to the collection and conservation of the kinds of evidence referred to that the claims of biological geology are here presented.

In considering the claims of science upon the individual it is desirable to make some reference to the amateur as well as to the special investigator. This recognition of nonprofessional work is desirable because the general subject of geology has acquired such a hold upon the popular mind and the opportunities for making observations with relation to it are everywhere so common that in every civilized country there is a multitude of persons who are in the habit of making more or less critical observations. Notwithstanding the usually limited and desultory character of such observations, they have often contributed materially to the general fund of geological knowledge, especially when accompanied by a faithful record and preservation of evidence. Indeed some of the most valuable facts in geology have been brought out by amateur observers, who themselves were hardly conscious that they had made their way alone to the frontier of acquired knowledge; and from the ranks of such observers have arisen many of the leaders in geological investigation.

Although only a small proportion of amateur observers can hope to accomplish so much as this, it is proper to assume that a very large proportion of them desire to contribute all they can to the advancement of science. These will therefore be included with other individual investigators in presenting the claims of science upon them, but for obvious reasons no reference need be made to those whose attention is directed to geology by mere curiosity or the desire for pecuniary gain. In the following remarks concerning the claims of science upon the individual the amateur will readily perceive what portions of them are applicable to himself.

It has been shown in the preceding essays that systematic geology could have no existence without the use of fossil remains, and also that without their use structural geology would be reduced to mere local and disconnected studies. It has also been shown that to arrive at a just estimate of the value of fossil remains in these branches of geology they must be thoroughly and systematically studied as representatives of faunas and floras as well as tokens of the formations in which they are found. The proper collection and preservation of fossil remains is therefore a subject of the greatest importance. In view of these facts it is the plain duty of every geologist upon beginning a piece of field work in structural geology to accompany every step of his examination of the strata by as full a collection as possible of the contained fossils and to preserve them, together with notes recording the results of his observations and a statement of all the facts relevant thereto.

If it were practicable to obtain from these fossils at sight all the information which they are capable of conveying, and if the judgment of every collector were so infallible that no coöperation by other observers and no final arbitration by the scientific public were necessary, it would not be essential to the successful prosecution of field work that fossils should be collected and preserved. But this is only a negative method of stating the imperative necessity of making full collections of fossils in the prosecution of investigations in structural geology and of preserving them for future reference.

Fossils thus collected and the facts concerning them recorded become invested with a value which differs materially from that which is possessed by ordinary property, and the claims of science upon them and upon the investigator with relation to them at once begin. These claims, as just intimated, require that a careful descriptive record be made of the stratigraphical conditions under which the fossils are found, including a directive record of the locality and designation of the stratum from which they were obtained. They also require that these records should be inviolably preserved and made inseparable from every specimen by indices that shall be as intelligible to other investigators as to the original observer.

Aside from the claims of science such precaution is necessary, because reliance upon memory alone is always unsafe in the most favorable cases, and it can at best give rise only to such oral traditions as are out of place in scientific work. The immediate preparation of the records and indices just mentioned is also necessary, because, while every specimen is at all times competent to impart to an investigator all obtainable knowledge of its own character, it can of itself convey no information as to its original locality and stratigraphic position. With this information secured for a collection of fossils they may be made at all times available as aids to scientific research not only by the collector, but by all other investigators.

The claims of science also require that immediately upon the completion of the original study of fossils thus collected and recorded they shall be placed where they will be freely accessible to the scientific public, and that reference to their place of deposit shall be made in connection with their publication. It is needless to say that the only suitable places for such deposit are public museums. It is only when this indispensable evidence is thus made accessible that the public can exercise that arbitration over the accumulated results of the labors of investigators which has been shown to be imperative.

The preparation and publication of complete records concerning the locality and strata from which fossil remains are obtained are necessary even from a biological point of view alone, especially when those remains are studied with reference to the range of organic forms in time, and without such records fossil remains are comparatively worthless as aids in geological investigation. It is unfortunately true that a not unimportant proportion of the paleontological material contained in our best museums is without these essential records, and that many of the publications containing descriptions and illustrations of fossil remains give no satisfactory information as to the localities and strata from which they were obtained or of the final disposition of the specimens. In such cases those authors and collectors have evidently assumed to decide for themselves and for science the exact taxonomic position in the geological scale of the strata from which their fossils came. In omitting such records as have been referred to they seem to have considered any information unnecessary that would enable the scientific public to repeat their observations upon their specimens or those which they may have made in the field, or to learn the biological characteristics of the formations from which their collections were obtained other than those which may be suggested by their own partial collections and their necessarily imperfect descriptions. It is doubtless true that such omissions have been largely due to an honest lack of appreciation on the part of authors and collectors of the importance of preserving such records, but it is to be feared that in some important cases the omissions or suppressions have been intentional. In the former class of cases the fact can only be deplored, but in the latter every geologist is justified in feeling that a crime has been committed against science.

The claims of geological science upon associations and societies are so generally and justly recognized that only the one which relates to the manner of publishing the results of investigation need be referred to in this connection, and this reference will be confined to the necessity of enforcing the claims upon individual investigators which have already been discussed. This claim may be sufficiently indicated by reference to those last mentioned, and by the remark that if it is the duty of individuals to publish records of their observations in the manner that has been stated, it is plainly the duty of those persons who may be in charge of the means of publication to refuse to publish the writings of those authors who do not conform to that requirement.

The facts and principles which have been stated in the preceding essays fully warrant the statements made on foregoing pages of this one, that individual authority can have no existence with relation to geological science, that the public must be the final arbiter of all questions concerning the value of proposed contributions to its advancement, and that a public exposition should be made of the evidence upon which any contribution to biological geology is based. In accordance with the last-named requirement it is necessary to consider the claims of this branch of science upon museums, the force of which is apparent when it is remembered that the material pertaining to it therein stored constitutes the vital evidence of the value of all contributions to its advancement, and that without such evidence this branch of science would be reduced to a mass of personal testimony.

In view of the great scientific value of fossil remains the following remarks are offered concerning the precautions which are necessary in their preservation. It is true that most if not all these precautions are observed in a large part of the principal scientific museums of the world, but it is also true that much remissness in this respect has occurred in others. Besides the propriety of referring to the latter fact, these remarks are necessary to complete my statement of the claims of science which constitute the subject of this essay.

Three general classes of specimens of fossil remains should be recognized in museum collections, namely, typical, authenticated, and unauthenticated. Under the head of typical or type specimens are included not only those which have been described and figured in any publication, whether original or otherwise, but those which have in any public manner been so used or referred to. While all such specimens as these should at all times be accessible to any competent investigator, the risk of loss or injury is so great that they should in no case be allowed to be taken from the museum building in which they are installed. Such specimens are in a peculiar sense unique, and there can be no substitution and no equivalent in value. Their loss greatly reduces the value of every publication any part of which is based upon them, and to that extent retards the advancement of science. It is not enough that other, and even better, specimens of presumably the same species may be discovered; the former constitute the original, the latter only supposititious evidence. Besides the risk of loss or injury to type specimens by removal from the place of their installment their absence is a disadvantage to science. That is, no one investigator should be allowed their use to the exclusion of any other.

The term "authenticated specimens" is here applied to such as have been studied and annotated by competent investigators and properly installed. Such material constitutes the bulk of every important museum collection, and next to the type specimens already mentioned they are most valuable. Their increased value is due to the scientific labor that has been bestowed upon them, and it needs only the additional labor of publication to constitute them type specimens and to make them of like value. Authenticated specimens when installed are ready aids to all investigators of such value that even the temporary removal of any of them from a public museum is, to say the least, of doubtful expediency.

Unauthenticated specimens are, of course, those which have not been studied and installed, and they constitute the great mass of material from which authenticated and type specimens are drawn. Among them are those which constitute the material evidence upon which original observations in biological geology are based. If these are accompanied by the records and descriptive notes which on a preceding page have been shown to be essential to their value, they constitute proper material for acceptance by museum authorities, but if not their installment should be refused, whatever their character may be. That is, to apply a statement made in another connection, no specimen of fossil remains should be admitted to permanent installation in any public museum which is not accompanied by such a record of the locality and stratum from which it was obtained as will enable any investigator to revisit the same. In every case of installment such records should be so connected with every specimen as to be readily accessible, and so arranged that the danger of loss or disconnection shall be reduced to a minimum.

The foregoing discussion of the claims of science upon museums is intended to embrace reference only to those which are devoted to the preservation of material pertaining to biological geology, but they are of more or less general applicability. These partial claims alone demonstrate the important relation that museums hold to science and to civilization as centers of learning and conservatories of the evidence concerning acquired knowledge. Museums should not only be made safe treasure-houses of science, but they should be what their name implies—temples of study—perpetually open to all investigators.

The claims of science upon geological organizations can not be discussed at length in this essay, but because the ratio of power for the advancement or retardation of science possessed by such organizations is so much greater than that of individuals working independently, it is desirable to make this brief reference to them. That power increases also with the ratio of the extent of the organization, and it is largely centered in the director. His responsibility, especially if his organization is a large one, is peculiar, and, to himself, of an unfortunate character. That is, while all or nearly all the advancement of science that may be accomplished by the organization is the work of his subordinates, retardation, if it should occur, is mainly due to his failure to require that each branch of investigation should be prosecuted in accord with all others, and the case would be little less than disastrous should he himself favor *ex parte* methods or fail to require a symmetrical development of the work in his charge. The claims of science upon geological organizations are therefore really claims upon their directors, and they are more responsible than any other class of persons for the preservation of the integrity of geological science.

SCIENTIFIC TAXIDERMY FOR MUSEUMS.

(BASED ON A STUDY OF THE UNITED STATES GOVERNMENT COLLECTIONS.)

By R. W. SHUFELDT, M. D.

In a valued communication, dated January 16, 1893, the present writer was honored by a request from the United States National Museum to furnish to it a paper upon what may briefly be termed "scientific taxidermy" in its widest sense. My attention was especially invited to the progress that had been made in the art of taxidermy, as exemplified on the part of the various methods used in the preparation of, and the modes of mounting resorted to, in the case of all kinds of animals for museum exhibition. It was proposed that in a general way this study should review the field, in so far as the collections contained in the U. S. National Museum and Smithsonian Institution were concerned, from those times when specimens of mounted animals were first being made by those institutions to the day when the opening of the World's Columbian Exposition at Chicago permitted people to see, in the varied groups and single examples of preserved animals from nearly every department in nature sent there, what could be accomplished in such matters through the operations of skilled moderns in the taxidermic art. What was expected of me was further definitely defined, in the letter to which reference is made above, in the following words: "We should like to have your unbiased opinion of the different pieces and kinds of work, whether favorable or unfavorable, and should be glad to have you indicate, so far as you feel disposed to do so, what lines of work, in your opinion, promise the best results if carried further, and what you think should be abandoned." This injunction, when faithfully performed in the case of any art whatsoever, is the only proper test of our progress in it, and it is through comparison alone of early accomplishments, work recently performed, and what is being done in the particular line at the moment, that we can inform ourselves precisely where we stand. Very soon it became possible for me to direct my attention to this matter, and a preliminary overlook of the field convinced me that my chief duty lay in making just criticism of the results attained on the part of the artist in taxidermy, rather than an enumeration and description of all the details of technique of that art. Much that refers to the last-named class of work has been and will be shortly still more thoroughly set forth in certain papers and reports published by the National Museum. Some valuable instructions of that kind, I understand, are in press at the present writing, and ere long the scientific taxidermist will have before him all that refers to correct methods of the mounting of animals, as well as plastic modeling and everything that has any bearing thereupon.

The present paper, then, will have little or nothing to do with what might properly be called the chemistry and mechanics of taxidermy, but will rather deal with it from the standpoint of the art student and biologist. At some points these two lines, however, converge, but never distinctly intersect each other; and my chief object will have been attained, if this paper proves itself to be a useful adjunct to the others upon kindred lines of inquiry. Properly, it will fill the place of the last of the series, for the reasons that have just been stated.

History goes to show that there has been just as much of an evolution, of progressive advancement, in the science and art of taxidermy as there has been in the case of the necessity for, the growth and improvement in the building of, the stocking, and the management of museums. To a very large extent these two developments have been *pari passu* in nature, and, in one sense, they are quite dependent upon each other. To instance my meaning, it may be said that a handsome, instructive, and scientifically preserved group of animals may utterly fail of a useful purpose by being placed upon exhibition in some poorly lighted, indifferently ventilated, and otherwise unsuitable museum-hall; while on the other hand no amount of architectural beauty and perfectness in the latter will ever serve to shield a group of animals that have been mounted by a person ignorant in all the departments of scientific taxidermy, from the criticism that work of that kind is sure to have continually poured down upon it by the intelligent natural historian.

It can be shown, then, that the taxidermic art, as in the case of all the arts and sciences, has had its dawn, having been nursed in a cradle of crude beginnings, far back in history, and since which time it has enjoyed a very remarkable career of development. To me there is no doubt but what it came into being with such pristine pursuits as prehistoric tanning, the embalming of the human body, and those of certain domestic animals as the cats and dogs found in prehistoric remains of Egypt and elsewhere. Sure it is that Hanno, the very ancient Carthaginian navigator, in the record that he has left us of his African explorations, made five centuries before Christ, gives an account of his discovery of the gorilla, and "having killed and flayed them, we conveyed their skins to Carthage." There they were preserved for many generations, and are, no doubt, the *Gorgones* described by Pliny (146 B. C.).

Our own Pueblan Indians, as the Zuñians and others, make very good "flat skins" of small birds to-day, an art no doubt traceable in them to the Mexicans, and the latter have probably practiced it for ages.

Montezuma, as stated by Cortez, possessed robes covered with the skins of the Trogan and other brilliantly plumaged birds. From the making of these flat skins for personal ornament to the desire to preserve in their natural appearance similar forms, as well as other small animals of all kinds, for the ornamentation of habitations, is both easy to be imagined, and very probable what took place. Gradually there was a demand for that kind of work, and it fell to the hands of those most skilled in its performance. They were the early taxidermists. Before specialization was ever dreamed of for the early arts of whatsoever kind, there always, so history teaches, existed a kind of an affinity bonding more or less closely together, the naturalist, the medical man, and the conservator of the curious in nature. Shakespeare's portrayal of the London apothecary is illustrative of this, within whose

> Needy shop a tortoise hung,
> An alligator stuffed, and other skins
> Of ill-shaped fishes.

Complete differentiation in certain quarters, in these days of the manhood of those sciences, has not as yet been thoroughly brought about, and even in some of the old German cities of the present time we yet hear of organizations known as "The Society of Naturalists and Physicians," and in some of our own late expeditions made under the auspices of the Government, the duties of "surgeon and naturalist" are relegated to one individual.

Now, although the mere preserving the skins of animals is an operation to be easily traced back through nearly all races of people to the dawn of history, this does not altogether hold true with the "mounting" of animals.*

Taxidermists are quite agreed that this phase of the art is of comparatively quite modern origin. For instance, Montagu Browne has remarked that—

> Little is known of the beginnings of the practice of the "stuffing" or "setting up" of animals for ornament or for scientific purposes; and it is highly probable, from what we gather from old works of travel or natural history, that the art is not more than some three hundred years old. It was practiced in England towards the end of the seventeenth century, as is proved by the Sloane collection, which in 1725 formed the nucleus of the collection of natural history now lodged in the galleries at South Kensington.
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> It was not until the middle of last century that any treatise devoted to the principles of the then little-understood art was published in France, Réaumer's treatise (1749) being probably the first. This was followed at intervals by others in France and Germany, until the beginning of the present century, when the English began

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* Probably, as Mr. Goode informs me, the oldest museum specimen in existence is a rhinoceros still preserved in the Royal Museum of Vertebrates in Florence. This was for a long time a feature of the Medicean Museum in Florence, and was originally mounted for the museum of Ulysses Aldrovandus in Bologna. It dates from the sixteenth century.

to move in the matter, and several works were published, notably those by E. Donovan,* W. Swainson,† Capt. Thomas Brown,‡ and others. These works, however, are now inadequate, and since the Great Exhibition of 1851, when the Germans and French taught British taxidermists the rudiments of scientific treatment of natural objects, several works have appeared upon the subject from the pens of American and English authors, such as J. H. Batty,§ R. Ward,‖ and Montagu Browne.¶

That the art is recent was also held by Dr. Holder, who, in an able address given before the Society of American Taxidermists, said that the—

> First authentic examples in this comparatively new art with which we are familiar are those produced through the patronage of the Prince Maximilian, of Nieu Wied, Germany. This distinguished naturalist had spent several years in exploring the bird region of North and South America. Equipped with every needful appliance for successful research, he included in the personnel of his staff a practical taxidermist, and the numerous species of American birds and mammals, embracing many types of great value, testify to the thorough exploration which the Prince accomplished in these regions. It was the good fortune of the American Museum of Natural History to come into possession of the entire collection of natural objects which formed the well-known museum of this naturalist, and thus, through this collection, we have representations of the earliest period of the art.
>
> Among the numerous examples contained in the Maximilian collection are a number that yet bear the original label in the handwriting of the Prince. The frequent occurrence of *Meiner Reiser* (my journey), accompanied by dates from 1812 upwards, a period comprising a full three score years and ten, is recorded testimony of great historical value. Unscathed as those specimens are by museum pests, they present a most satisfactory evidence of the reliability of arsenical treatment as a means of perpetuation well nigh indefinite. How much earlier the art was practiced we have no definite knowledge. The numerous stuffed skins of reptiles, or rather mummies, found in Egyptian tombs naturally claim our notice as perhaps the earliest examples.**

Extending over a very considerable period of duration we next find the art of taxidermy passing through a stage of its development, of which no end of examples quite parallel with it might be cited from the early histories of other arts and sciences. Photography and chemistry are excellent instances of it. During the times to which I refer, taxidermists both in this country and Europe, with but rare exceptions, could be grouped in two classes—the first, and by far the most numerous, was chiefly represented by men coming from the lower planes of society, who endeavored to throw as much mystery about their operations as possible; in fact, to keep their art a secret one, and if divulged at all, only done so at a high figure. The second class, as a rule better men socially, consisted of those who seemed to think that to either be a taxidermist or even to publish anything on the subject, required an humble apology to society. My private library contains works illustrative of both these classes. The first is a miserable little volume of some thirty pages published by its author, Mr. S. H. Sylvester, at Middleboro, Mass., in 1865, and entitled "The Taxidermist's Manual, giving full instructions in mounting and preserving birds [etc.], sec. ed. (Price, $1.)." Apart from the ridiculous meagreness of the information it affords, a single leading page is entirely devoted to the following "suggestion:"

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* Instructions for Collecting and Preserving Various Subjects of Natural History, London, 1794.

† The Naturalist's Guide for Collecting and Preserving Subjects of Natural History and Botany, London, 1822.

‡ Taxidermist's Manual, Glascow, 1833.

§ Practical Taxidermy and Home Decoration, New York, 1880.

‖ Sportsman's Handbook of Practical Collecting and Preserving, London, 1880.

¶ Practical Taxidermy, London, 1879, second edition, 1884; also, article Taxidermy, Encycl. Brit., ninth edition, vol. XXIII, p. 89, from which the above quotation is made.

** J. B. Holder, Dr. Third Annual Report of the Society of American Taxidermists, Washington, 1884, p. 40. In this connection it is well worthy of notice that in the same report Mr. L. M. McCormick (then of the U. S. National Museum) presents us with a most valuable and useful Bibliography of Taxidermy (pp. 91-112), wherein the earliest work cited on the art is that of Johann Daniel Geire, which consists of merely two pages from the Miscell. Acad. Nat. Curios, entitled "De vernice ad conservanda insecta et animalia," being published December 2, 1689. Nothing of any importance, however, appearing between that date and the well known work of Ferchault de Réaum, which was given to the world in 1748.

> As common things lose their charm, so is it more particularly in this art. A person having this work should not leave it exposed to the eyes of the curious. The same caution should be used in the practice. Work by yourself that none may know the mysteries of the art, unless they are willing to pay for the information as you yourself have done.

No less a book than the one published by Capt. Brown illustrates the second class to which we have referred.* In his preface this author remarks that—

> In the following treatise it has been my object to attend more to rendering the meaning clear than to elegance of language; and, besides, to get the work up in a style at once creditable and moderate in price, so that it might be generally useful. At the same time I have preferred avowing myself the author to publishing the work anonymously, being firmly of opinion that no man should publish on a subject which he is ashamed to acknowledge. (p. vi.)

Such a "suggestion" as has been given us by Mr. Sylvester will never again appear upon the page of any standard work devoted to the art of taxidermy and published by a civilized nation any more than Capt. Brown's thought of apologizing for the admirable little treatise which he has given us on the subject will ever be repeated in a similar work. Capt. Brown had the less to be "ashamed" of in his book, for in his introduction he places himself upon the record by his observations as being one of the very first to sound the keynote, which, swelling through the last quarter of a century, has had its due influence in lifting taxidermy from the realm of an ignoble pursuit to the broad platform of one of the most important and exact of all the sciences. I refer to the paragraph in which he has said:

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*Thomas Brown (Capt.), F. L. S., late president of the Royal Physical Society, etc. The Taxidermist's Manual; or, The Art of Collecting, Preparing, and Preserving Objects of Natural History, designed for the use of Travelers, Conservators of Museums, and Private Collectors. London and Edinburgh, 1870. (Plates VI, pp. 150.)

> Although considerable advances have been made of late years in the art of taxidermy, it is still far from perfection. This is to be attributed, in a great measure, to the education of the persons who practice this art; for among all I have met with employed in the preservation of animals, none have had the advantage of anatomical study, which is quite indispensable to the perfection of stuffing. One or two individuals, it is true, have attended to the structure of the skeleton of man and a few of the more common animals, but this is far from the information which they ought to possess; for nothing short of a general and extensive knowledge of comparative anatomy can qualify them sufficiently for an art which is so comprehensive and varied in its application (pp. 2, 3).

Prophetic words, indeed, and not in a few quarters has the prophecy of this distinguished authority been largely fulfilled. More light, however, is needed in other places, and in many of our museums of the very highest standing the examples of taxidermy they offer us are far, very far from our ideal of what they should be.

Charles Waterton is another worthy name that must not be forgotten here, and fully seventy years ago, in his Wanderings in South America, he wrote, in his quaint and impressive old style, yet pregnant with truth:

> Were you to pay as much attention to birds as the sculptor does to the human frame, you would immediately see on entering a museum that the specimens are not well done. This remark will not be thought severe, when you reflect that that which was once alive has probably been stretched, stuffed, stiffened, and wired by the hand of a common clown. Consider, likewise, how the plumage must have been disordered by too much stretching or drying, and, perhaps, sullied, or at least deranged, by the pressure of a coarse and heavy hand—plumage which, ere life had fled within it, was accustomed to be touched by nothing rougher than the dew of heaven and the pure and gentle breath of air.

These are potent words as coming from the pen of a man who wrote them within a year or two of three-quarters of a century ago. Especially is this the case when that ingenious naturalist in the same work enjoins that—

> If you wish to be in ornithology what Angelo was in sculpture, you must apply to profound study and your own genius to assist you.
>
> You must have a complete knowledge of ornithological anatomy. You must pay close attention to the form and attitude of the bird, and know exactly the proportion each curve, or extension, or contraction, or expansion of any particular part bears to the rest of the body. In a word you must possess Promethean boldness, and bring down fire and animation, as it were, into your preserved specimen.

"Repair to the haunts of birds on plains and mountains, forests, swamps, and lakes, and give up your time to examine the economy of the different orders of birds," is also the kind of study Waterton recommended in 1825 to those who desired to preserve birds in their strictly natural attitudes as they assumed them in life and in nature.

Standing almost alone as he did as a sound instructor of the taxidermic art in the first quarter of the present century, he is represented at this writing, or in the very last part of the century's last quarter, by scores of teachers in Europe and America who entertain precisely similar opinions. Not only this, but recruits are rapidly coming to the ranks as time hastens on, and it is quite safe to predict that in another century, or even less, the old-time "bird-stuffer" will cease to be found "in the flesh" among us.

Already I have given above, in the words of Montagu Browne, who have been the chief promoters of this art in Great Britain; other nations also have in this way powerfully contributed to the material progress of taxidermy. In France the immortal names of Verreaux, Verdey, and others had a most beneficial influence; and our own country has been by no means backward in this particular.

Within the past ten years or more the published opinions of a number of these writers are the best evidences upon the substantial nature of the progress of this science that we can here adduce, and by quoting some of them I resort to the most effective means in my power to illustrate what taxidermy has attained to in those places where its standard is now considered to be at the highest plane of its present development.

Turning again to the article Taxidermy, by Mr. Montagu Browne, already referred to above, we find him concluding it thus:

> A new school of taxidermy, with new methods, whose aim is to combine knowledge of anatomy and modeling with taxidermic technique, are now coming to the front, and the next generation will discard all processes of "stuffing" in favor of modeling. Within the limits of an article like the present it is impossible to do more than glance at the intricate processes involved in this. In the case of mammals, after the skin has been completely removed, even to the toes, a copy is made of the body, posed as in life, and from this an accurate representation of form, including delineation of muscles, etc., is built up in light materials; the model is then covered with the skin, which is damped and pinned in to follow every depression and prominence; the study is then suffered to dry, and, models having been made, in the case of large animals, of the mucous membrane of the jaws, palate, tongue, and lips, these are truthfully reproduced in plastic material. The ordinary glass eyes are discarded, and hollow globes, specially made, are hand-painted from nature, and are fixed in the head so as to convey the exact expression which the pose of the body demands. Birds, if of any size, can be modeled in like manner, and fishes are treated by a nearly identical process, being finally colored as in a "still-life" painting.
>
> To give a life-like appearance, attention is also paid to artistic "mounting." By this is meant the surrounding of specimens with appropriate accessories, and it is well exemplified by the new work shown in the natural history museum at South Kensington, where, for example, birds are arranged as in a state of nature, feeding, or flying to their young, sitting on their eggs, swimming in miniature pools, or preening their feathers whilst perched lovingly side by side, and surrounded by exquisitely modeled foliage and flowers. This, with correct modeling of the specimens, which, except in rare instances, is not quite so striking in the new groups, indicates the future of the art, the hope of which lies in the better education of taxidermists as designers, artists, and modelers.

Not only should they be better instructed in designing, in art, and in modeling, but, what is quite as important, they should be trained especially in the power of correct observation in animal morphology, and in other matters which will be enumerated further along.

Dr. Sharpe has given us a very able article touching upon the question of artistic taxidermy.* He says:

> At Leyden, where a staff of trained taxidermists is kept in the museum, some attempt has been made to vary the usual mode of stuffing animals by representing them in varied and active positions, and thus the general effect is never monotonous. But this was never done in the British Museum, and the constrained attitudes of many of the specimens exhibited at Kensington form part of a legacy from the parent institution, the bad influence of which it will take many years to efface. Thousands of specimens have been unmounted already or have been transferred to the duplicates and distributed to such provincial museums as prefer to tread in the old paths, and will accept specimens belonging to the bad old times.
>
> The credit of having broken away from time-honored tradition, in the mode of mounting animals in this country is certainly due to Mr. John Hancock, who taught how to combine scientific accuracy and artistic feeling. Mr. Hancock's name is at Password throughout England wherever taxidermy is mentioned, and in London his ablest representative has probably been Mr. A. D. Bartlett, the well-known superintendent of the zoölogical gardens, to whom we owe many of our most beautifully mounted specimens in the bird gallery. But the first to suggest this combination of art and taxidermy *for an entire museum*, was undoubtedly Mr. E. T. Booth, of Brighton, whose collection of British birds in the Dyke Road Museum, still remains one of the sights of England, and is not surpassed in interest by any natural history exhibition in the whole world. Here may actually be seen our native birds in their haunts, every species being represented as in a wild state, with corresponding natural accessories, reproducing as nearly as possible the surroundings as they were when the birds were alive, and representing the scenes sketched by the collector at the time of capture. Many years before we actually saw Mr. Booth's collection, its fame had reached our ears, and the idea seemed to us to indicate what the museum of the future, ought to be; thus we lost no opportunity of advocating this system of artistic taxidermy in all our public lectures. At Leicester the notion was well received, and some groups of British birds were mounted under the auspices of the natural history committee of the town museum, until by the appointment of Mr. Montague Brown, as the curator of the museum, Leicester obtained the services of a taxidermist as skilled as he is energetic, and the result has been that the system of natural mounting has been extended to the entire collection of birds, so that not only British, but foreign species are represented with their familiar surroundings in a state of nature. The Leicester Museum is the only one which has applied the principle in its entirety with the utmost success and public appreciation. * * *

And further along in his article, and referring to the series of the groups of British small birds and their nests in the South Kensington Museum, Dr. Sharpe adds:

> In this corridor are placed most of the smaller perching birds, some of the artistic work being very satisfactory. The mounting of the specimens has been done by Mr. Pickhardt, who, when he exercises his full powers, is probably without a rival as a bird-stuffer, and the majority of the plants have been reproduced by Messrs. Mintorn, of Soho Square, but a great deal of the arrangement of the cases is done in the taxidermist's room of the museum by Mr. James West, one of the staff. And here it

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*Sharpe, R. Bowdler: Ornithology at South Kensington. The English Illustrated Magazine, No. 51, December, 1887. London: Macmillan & Co., pp. 165–175. Illustrated.

> must be explained that the groups of British birds exhibited are absolutely true to nature, the birds being in every case the actual ones which built the nest in the identical situation reproduced in the case.

So wonderfully interesting is Sharpe's article that the writer would fain republish here every word of it, but we must hasten on to the expression of opinions of others.

When commenting upon the "Common Faults in the Mounting of Quadrupeds," our veteran taxidermist, Mr. William T. Hornaday, has said:

> The task of the taxidermist, if properly appreciated, is a grave and serious one. It is not to depict the mere outline of an animal on paper or canvas and represent its covering of hair, feathers, or scales; nor is it to build up a figure of yielding clay and cast it in plaster. It is to impart to a shapeless skin the exact size, the form, the attitude, the look of life. It is to recreate the animal, or at least so much of it as appeals to the eye; to give it all that nature gave it except the vital spark. It should be an exact copy, as if it were a cast of the animal as fashioned by nature's cunning hand. It must stand the crucial test of being viewed from all points—from the side, the front, from behind, above, and below.
>
> More than all this, the animal must be prepared to stand the test of time. It must not swerve from its poise; it must not shrink nor change its form; it must retain its smoothness and resist the ravages of destroying insects.*

Mr. Hornaday, it will be remembered, was at one time in charge of the taxidermical department of the U. S. National Museum, and many of his most successful accomplishments, grand groups of our larger mammals, preserved in the most masterly style, are in the cases of that institution—silent attests to the durability and thoroughness of his work. A number of these will be noticed further on in the present paper.

There was much in Mr. Hornaday's studio at the National Museum that reminded me of the workshop of that giant among American taxidermists of his time, the late John G. Bell, of New York. There I met him over a quarter of a century ago. His place was somewhere down upon Broadway, and his room upon the second or third story of the building. At the entrance door downstairs was a small case containing a mounted scarlet ibis and a few other birds, to invite attention to those in search of his rooms above. At that time, about 1868, I was a student of one of Mr. Bell's best graduates, Mr. James W. Jenkins, now of Madison, Ill., and very well do I remember my first introduction to that Broadway establishment. I had been engaged by Prof. Albert S. Bickmore to accompany, as naturalist, one of the Polar expeditions, then organizing, to make collections for the American Museum of Natural History, and had been sent with specimens of my bird-skins to Mr. Bell to have him pronounce upon them and my work generally, with the view of having his opinion on my fitness for the position. As I entered the room I observed an old red fox chained to a bolt in the wall, but lying down with his head between his forepaws and eyes upturned in my direction. On the floor in his immediate neighborhood were a number of beautifully mounted birds on stands, and fearing lest the animal should suddenly arise if I came farther into the apartment, and do some damage, I started to pass round and give him as wide a berth as possible. The room was small, and Mr. Bell was engaged with a couple of students at a window opposite where I entered, but he turned in time to see my detour around the fox, and did not spare me in his merriment at my thinking the animal was alive. To some extent, however, he mitigated my chagrin by saying he had deceived over a hundred visitors with that fox during the five years it had lain there. I could not help but admire his tall and well-knit frame, his piercing blue eyes, and general bearing. His specimens too, which I examined, were perfect works of art, and, as all know who have ever had a similar opportunity to study them, were the admiration and the envy of the taxidermists of those days, now long gone by.

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* Third Ann. Rep. of the Soc. Amer. Taxidermists, p. 67. 1882–'83.

Of all the taxidermical institutions, however, that this country has developed none can in any way compare with the natural science establishment of Prof. H. A. Ward, of Rochester, N. Y. Not only has Prof. Ward powerfully influenced for good the growth of the art in America, or we may truthfully say throughout the civilized world, but he has by inspiring others with his enthusiasm and energy built up a school of advanced taxidermists that are worthy emulators of his skill, and who have with marked ability passed the torch in many directions. There is not a museum in our land at all entitled to bear the name that is not in some way, whether directly or indirectly, indebted to him for improvements of all kinds in its taxidermic methods, and the proper modes of exhibiting materials illustrative of the kindred arts and sciences.

Mr. F. A. Lucas, who has done so much to develop the exhibiting of osteological subjects, and models and specimens of both vertebrates and invertebrates at the U. S. National Museum owes much of his success to his early training under Prof. Ward, and the art is not only under lasting obligations to him, but through his wise teaching it has been firmly and permanently placed in that quarter upon a safe and lasting basis. That Mr. Lucas appreciates "The scope and needs of taxidermy" in their truest sense no one can doubt who has ever read his article of that title in the Third Annual Report of the Society of American Taxidermists.

Mr. Frederic S. Webster is another of whose writings and productions the country has every reason to be proud, and the high standard of work so constantly put forth by that artist has always had a most beneficial effect upon the younger aspirants in the United States.

Attention of American and European students has also been drawn from the old-time museum models in taxidermy and directed to a closer copying of nature through the far-reaching works of Dr. Elliott Coues, who has said, in his Key to North American Birds:

> Faultless mounting [of birds] is an art really difficult, acquired by few; the average work done in this line shows something of caricature, ludicrous or repulsive, as the case may be. To copy nature faithfully by taxidermy requires not only long and close study, but an artistic sense; and this last is a rare gift. Unless you have at least the germs of the faculty in your composition, your taxidermical success will be incommensurate with the time and trouble you bestow. My own taxidermical art is of a low order, decidedly not above average. Although I have mounted a great many birds that would compare very favorably with ordinary museum work, few of them have entirely answered my ideas. A live bird is to me such a beautiful object that the slightest taxidermical flaw in the effort to represent it is painfully offensive. Perhaps this makes me place the standard of excellence too high for practical purposes (p. 40, 2d ed., 1884).

Powerful impulses of the best kind have often been instilled into the art through the patronage and guidance of those who have at different times in their careers been either directors of, or curators in, our larger museums. I speak especially in this country of the Smithsonian Institution and the National Museum.

Through the wise and ever-operative influence of our great Nestor of all the sciences zoölogical, Prof. Spencer F. Baird, he so directed the management of those institutions when under his administration that their workshops came to be the great drill ground for many of the most deserving who possessed the evidences of success in skillfully preserving all manner of objects illustrative of the various classes of the animal kingdom.

What has been the outcome of much of his wisdom we hope to portray, however faintly, in the following pages. Most ably has Prof. Baird's influence been fostered and furthered by the succeeding efforts along similar lines of those who are his successors in the administration of the Museum and who at the present time are doing so much to give actual shape and form to what before was simply in outline and crude beginnings. Where such influence tells the best is in the directing of the skilled efforts of the taxidermic artist in those cases where the latter, through lack of opportunity, fails to possess the requisite knowledge of the forms and habits of many of the world's rarer animals. Indeed, frequently some of the best group pieces of mounted mammals, birds, and others, have resulted from the combined knowledge and skill of the capable zoölogist on the one hand and the trained taxidermist upon the other. Not a few of such groups are to be found in the collections of the Government museums.

Very often it will be seen, then, in the future, I think, that fine, realistic groups of mounted animals will be produced that will be composites; in other words, will be the resultant of the combined labors of the biologist, the taxidermist, the modeler, and the designer and artist. Rarely will all these prerequisites be found in one man, though occasionally undoubtedly it will be so; then the museum which can claim his services will be very fortunate.

Among many others who have been more or less influential in insisting upon the highest standard for the art, in each and all of its branches, we must not forget the distinguished names of Joseph H. Batty, the author of a number of works upon practical taxidermy; C. J. Maynard, the well-known writer of the The Naturalist's Guide; Prof. J. W. P. Jenks, who, through a long and honorable career, has never ceased his efforts in not only doing much for taxidermy, but in the introduction of study series of animals in the public schools in New England and elsewhere; and a host of other worthy promoters.

At the National Museum, at Washington, in recent times, in addition to the fine group pieces of Hornaday and of Lucas, there has been some masterly work done in the taxidermic art by Mr. Joseph Palmer, and his son, Mr. William Palmer; also by Mr. Nelson R. Wood and Mr. Henry Denslow, the nature of which I have already noticed in a popular article published in The Great Divide, of Denver, Colo., for December, 1892, and which will be referred to again in the present connection.

From the opinions, then, of the European and American taxidermists as I have thus far quoted them, it is evident that the general development of the art shows at this time very marked improvement, and the tendency among its votaries is to raise it to the highest possible standard of excellence. With such a movement the writer is in the most hearty sympathy, and I am of the opinion that the day is not far distant when taxidermy will find its lawful place on the platform of the most highly cultivated of the arts. As a matter of fact it has every right in reason to stand side by side with painting and with sculpture, and its students need have no fears in claiming such a station for it.

To be a scientific taxidermist requires, or should require, in the first instance, a very thorough education, quite equal to that given by our best colleges. He should have a complete training in biology, with especial emphasis having been placed upon his studies in comparative morphology, so as to be familiar, as far as possible, with the vertebrate skeleton and topographical anatomy, to include more particularly the study of the superficial muscles of vertebrates. He should have such a conception of physics as to be able to decide upon the possible and the impossible in animal postures. In a way, he should be a good artist, be enabled to use the photographic camera, and make intelligent sketches of animals of all kinds and their natural haunts. He should be fully abreast ot the times in all taxidermic technique *per se*, and possess fine mechanical skill.

As full a knowledge as can be attained of the habits of animals from personal observations should be added, as well as a constitutional desire to become familiar through current literature of all advances made from time to time in his art, and a healthy ambition to ever utilize them and improve upon the same.

So far as human ability is concerned, were I at this moment called upon to decide as to the relative merits of the talent required to paint a life-size elephant, to sculpture one in stone, or to properly preserve one in a natural position and color so it would safely resist the ravages of time and all else that might injure it, I should not hesitate a moment in rendering an opinion, for I should say it lay with the scientific taxidermic artist. Mind you, when I do thus decide I have had in my lifetime, with specimens of smaller animals, experience with all. At the best, however, the difference is but of very small degree, and yet the taxidermist, in a way, should be master of both the art of the painter and the art of the sculptor, for frequently he has to use the brush with great fidelity to nature, and the time is fast coming on when he must be able to build up, in clay at least, the entire forms of the larger animals which he aims to preserve.

Next, it may be asked, Why a collegiate education? Simply because I believe a man in any calling is a better man in every way for having received the four years' training which a university gives him. And surely neither the taxidermist, nor the artist, nor the sculptor offer any exception to the rule. Moreover, everything that the skilled taxidermist would acquire in a college course would materially assist him in his profession in his subsequent career. Whatever may have been written, and whatever may have been said on the broad question of the college man versus the self-made man, it has been my experience that the kind of men that bring our country the most desirable recognition from other nations are those who have received a liberal education. A taxidermist should be a good general biologist, and he should pay especial attention to the habits of all animals in nature; the geographical ranges of faunæ; breeding habits; the peculiar habits indulged in by various kinds of animals; their natural resorts during times of feeding, amusement, or conducting their young. Plants of all kinds should with scrupulous care be studied from the taxidermist's standpoint, as well as the localities where they grow, nature of surfaces of the ground, and all else presented on the part of field, ocean, stream, and forest. Nothing should escape his constant study of such matters, and, above all else, he should cultivate the faculty of patience. An impatient man, it may be safely said, can never attain to the highest position the art has in its power of giving him.

In comparative morphology, as I have said, he should devote a great deal of time to the skeleton and to topographical anatomy. The study of the skeleton is of the very highest importance, as without a knowledge of it there is no hope at all of a man being a perfect taxidermist in all its varied departments. Normal movements of the articulations and the *ligaments* that control them should receive most careful consideration, and no opportunity lost to study such matters scientifically upon all kinds of animal cadavers. Special drawings made by the taxidermist should record special points observed and worked out—the possibilities in normal movements and postures as exhibited by the osseous system. In its entirety, however, this can not be fully appreciated without a full knowledge of the muscular system, for there are possible movements that the skeleton, when cleaned and dried, is capable of making, which, in life, become impossible from the operation of muscles and tendons. So myology must be systematically studied *pari passu* with the subject of skeletology, and with the aim constantly in view of acquiring a clear insight into the normal postures of animals.

This leads to the consideration of the question of correct form, and to acquire that requires prolonged research and study upon the entire subject of topographical anatomy. Muscles extended; muscles contracted; muscles at rest; contours formed by the normal deposit of adipose tissue; contours formed by parts of the skeleton that are merely subcutaneous; contours formed by the presence of glands of all kinds, of sesamoidal bones, cartilages, and every other structure that may in any way affect the normal contour of an animal. To this must be added the careful study of all external characters proper, as the hair and analogous parts, throughout the animal kingdom—the eyes and their surroundings, the nasal structures, the mouth of all vertebrates and invertebrates. Indeed, there is not a point properly falling within the range of topographical anatomy in its very widest sense that should be beneath the special notice of the taxidermist.

Colors of parts should also receive marked attention; and the taxidermist should keep a notebook devoted to that one branch alone. Never should an opportunity be lost to record by actual painted sketches the colors of every external anatomical character presented on the part of any animal whatsoever. Zoology itself would be far freer from gross errors of the color descriptions of animals were naturalists, as a rule, more careful in such matters. This is marked by the case in ichthyology and in the naked skin-tracks of mammals and birds. We, then, are naturally led to the question of drawing and painting; and no one will doubt the necessity of a taxidermist being more or less proficient in all these branches. But none of them will be of any service to him unless the power be supplemented by the more important faculty of being a correct observer, and to be a correct observer is to see and appreciate things as they really exist. Taxidermists should have a knowledge of not only making correct sketches of all kinds of animals and their haunts and of plants and coloring them correctly, but they should be enabled to use such instruments as are demanded in making reduced drawings correctly from large subjects. Coloring in oil is also of great value in restoring the tints in some cases on the skins of preserved animals, and the student in this art should constantly aim to cultivate his sense of color appreciation and of the matching of all the various shades.

More or less pertinent to this question, Capt. Thomas Brown has said: *

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* Taxidermist's Manual, pp. 3, 4.

A knowledge of drawing and modeling are also indispensable qualifications, to enable the stuffer to place his subject in a position both natural and striking. It is the too-frequent practice for the stuffer to set about preserving the animal without having determined in what attitude he is to place it, so that it will appear to most advantage and be in character with the ordinary habits of the creature. This he leaves to the last efforts of finishing his work, and, consequently, its proportions and character are likely to be devoid of all appearance of animation.

The first thing, therefore to be attended to in all great national natural history establishments is to choose young persons who are yet in their boyhood to be instructed in this art most important to science. Their studies should be commenced by deep attention to drawing, modeling, anatomy, chemistry, while they at the same time proceed with the practical part of their art. Every opportunity of examining the habits and actions of the living subject should be embraced and its attitudes and general aspect carefully noted. Without strict attention to these points, so manifestly obvious, the art of preserving animals never will attain that degree of perfection which its importance demands. On the other hand, if this art is pursued in the manner here recommended, artists may be produced who will fulfill the objects of their profession with honor to themselves and advantage to their country. Would any person expect to arrive at eminence as a sculptor if he were unacquainted with the established preliminaries of his art, namely, drawing and anatomy? The thing is so self-evident, that I am only surprised it has not long ago been acted upon. Upwards of twelve years have elapsed since I pointed out these facts to the professor of natural history in the University of Edinburgh, but things continue as they were before that time.

Since Capt. Brown wrote these words, and very true ones they are, another art and the accessories to it have enormously developed. I refer to the art of photography. Now, if there be one thing more useful to the scientific taxidermic artist than another it is a full practical knowledge of the use of the photographic camera and all that directly pertains thereto. Its application is most varied, and is greatly enhanced by the use of the time and instantaneous shutters. By the use of the camera the taxidermist can secure subjects that the unaided eye and pencil can never give him, and these are all kinds of animals in rapid motion, and they may be obtained, after a due amount of practice, by the use of the photographic camera. One has but to study the superb series of photographs obtained through the indefatigable Eadwuard Muybridge to appreciate my meaning here. No taxidermist who has any regard for an attainment of excellence in his calling should neglect to make good photographs of all the living animals that he can, and that upon every possible opportunity. This should not be confined to wild animals alone, but to all the domestic ones in their most common attitudes.

Horses, cows, dogs, cats, pigs, and all the barnyard fowls should by no means be beneath his notice. They should also be taken from many points of view, I might say from every possible point of view, and then be nearer what the taxidermist really needs in his work. He should carefully keep a series of large-sized and suitable scrapbooks wherein all his photographs should be carefully inserted, together with his sketches, and everything of the kind, with their full histories and notes, etc., recorded upon opposite pages. Photographs should be made also of plants of all kinds directly in the places where they occur in nature; also the resorts of animals of every description; birds' nests; and, in short, every possible natural subject and creature and locality that the taxidermist may be called upon to reproduce in his workshop. He should also make photographs of dissections, the skeletons of animals, models, and designs, and of dead animals. Ever should it be prominently before his mind that one of the greatest of all taxidermical desiderata is the obtaining of good models of all kinds and descriptions, and models true to nature in every sense of the word. Frequently artists who are correct observers and portrayers of animals make fine illustrations of them, either in the form of colored or uncolored prints, and these the taxidermist should secure for his "note book" whenever he possibly can.

On this point Mr. Staebner has very truly remarked:*

> It would seem almost superfluous to insist on the value, nay the absolute necessity, of good illustrations as aids to the taxidermists, were it not that the importance of the subject appears to be hardly yet fully appreciated by many of the very ones to be most benefited.
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> There was a time, now happily past, as the work exhibited by this association abundantly proves, when individuals who mounted birds and animals (as their cards set forth) were content to ram a hide full of packing material, sew it up, and call the effigy by this or that name, according as this or that animal was desired. The degree of monstrosity, if it may be so termed, thus produced, was in inverse ratio to the care of the workman for his art and his knowledge (often scant enough) of the external appearance of the animal he was attempting to reproduce. These monstrosities of taxidermy are still to be seen in many of our public museums, where, let us hope, they at least serve the purpose of teaching the younger generation, how not to do it.
>
> As in all other departments of human activity, so in this is the skilled workman plainly superseding the unskilled, and the class of work thus becoming more and more a source of pride and satisfaction. The man with a love for his art, necessarily something of a naturalist and with a naturalist's care, anxious about the correctness of all the details of his work, must utilize all the aids at his command, and of these aids accurate drawings and paintings occupy the chief place. These are the taxidermist's works of reference to which he goes for information precisely as another goes to his encyclopedia, since the ability is given to no man to carry all the minute points of an animal's external appearance in his mind. That the representations for this purpose should be what are strictly understood as works of art is obviously unnecessary.
>
> The objects to be secured, however, and which they should possess to meet the requirements of the case are: (1) accuracy of outline; (2) truthfulness of attitude, and (3) in order of importance, correctness of coloring, and in so far as they conform to these things are they already, by just so much, works of art. What is technically known as artistic effect should here be a secondary consideration. Having secured the first three essential points, attention may be given to the last.
>
> In the case of rare animals such representations as is well known are the sole reliance of the taxidermist. That they have a value even in the case of more familiar animals may be instanced by the case of the walrus. The pictures of this mammal

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* Staebner, F. W.: Note on the value of animal illustrations to taxidermists. Third Ann. Rep. Society of American Taxidermists, 1882-'83, pp. 72-74.

in all the professed works on zoölogy and natural history, even in so good and generally correct a work as Brehm, are glaringly false, and it is only within the last few years that anything approaching truthful representations—figures drawn from observation instead of copies of previous drawings originally evolved from the artist's "inner consciousness"—have been given us, and so it happens that of mounted specimens of the walrus showing the true appearance of the animal almost the only ones at the present time are the one at Cambridge, and that other at the United States National Museum mounted by Mr. Hornaday.*

How often has a painstaking taxidermist wished for a means of refreshing his recollection on some little matter of detail concerning a creature's anatomy, and been obliged to finally guess at it because of the lack of adequate illustrations. Let me not be understood as descrying the assistance afforded by zöological gardens. It is just here that they come into play, and as it is better for the taxidermist to observe at first hand, so these are even better than drawings for reference; but the fact is they are far from being readily accessible at best in this country, and in the few instances in which this objection does not apply the variety of specimens which they contain is too limited, so that we are still compelled to supplement them by a more ready source of information, and thus we fall back upon pictorial representations as on the whole most convenient. As above implied, however, these representations must be taken from life by skillful hands, and must give us the animals as they look, and not as the artist thinks they ought to look.

But in order that we may have such we must encourage those who work in this line—the Landseers, the Baryes, the Wolfs, the Spechts, etc., whom, under a change of name, we have in this country in the Beards, the Kemeyses, etc. We must make it profitable for them to undertake the work we so much need, and if we have the good of taxidermy at heart, if we have faith in its capabilities as an art we will do this, for in so doing we are helping it and ourselves as well as them.

In The Auk for April, 1891, the present writer published a letter entitled "Camera notes for ornithologists," which, not being of very great length and quite in line with the views just quoted above, will, I think, bear repeating here, and enlarging upon a little further along. I said:

At the last congress of the American Ornithologists' Union there were exhibited many photographs of all sorts of ornithological subjects, and the majority of them were examined by the writer with great care.

For one, I was disappointed in the results arrived at by the authors of the most of them, as there appeared to be such a total absence of any practical result attained. Among the best that I saw were some taken by Dr. Edgar A. Mearns, but even those, the work of a most painstaking naturalist, did not come up to what the camera is capable of performing for practical ornithology. Little or nothing is to be gained in this latter direction by photographing bunches of game or badly mounted specimens and similar subjects. Any tyro can accomplish as much as that, and ornithology not be called upon to thank him for it.

In the present communication it is the writer's object to relate some personal experiences which may be of assistance to those interested in this line of work.

Now, in the first place, as to some of the objects to be attained: There are a number of these. We may desire, for example, a sharp, clear photograph, which either may be natural size or may present the subject reduced, for the use of the lithographer, in order to place in the latter's hands an accurate figure to be copied on to stone, and the plates printed therefrom to be used for illustrative purposes. The subject may be a bird, its young, or its nest, or a dissection of a bird, or its skeleton, or its eggs, and so on indefinitely. Owls present to many artists difficult subjects to draw satisfactorily, but there is no reason why we should not, by the aid of the camera and a 5-by-8 plate, for a small sum, and in very short order, have ready for the lithographer a life-size figure, and a perfectly accurate one, of such a species as *Nyctala acadica*, or upon a similar plate a handsomely reduced figure of *Bubo virginianus*. Again, by varying our material, colored figures are easily obtained for like purposes. Photographs of this character may also be used to make wood cuts from, or they may be reproduced by some of the various styles of "process work." Yet another object: We may desire to produce by the aid of a camera an accurate figure of any of the above-mentioned subjects from which an electrotype can be directly made. This also is now easy of accomplishment, and such illustrations meet a vast variety of needs in descriptive ornithology. These, then, are some of the principal objects to be attained, viz, clear, accurate figures, either life size or reduced to any desired size, and either plain or colored, which (by the use of different materials) can be used at once by either the lithographer, the wood engraver, the "process worker," or the electrotyper.

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* In this connection see the various figures of the walrus illustrating the present report, Plates LXXXV, LXXXVI.

Your material must be the best in all particulars. I use a large, first-class, quick-working lens; a Blair's camera for the 5 by 8 plate; the iron and oxalate developer, using the chemically pure material (filtered); bichloride of mercury and ammonia for intensifying, etc.

Our method of procedure can best be illustrated by a few examples. Say we wish to reproduce, life size, a hawk's egg. Suspend on the wall opposite and under the strong sunlight, a smooth, half-inch pine board; cover this with white blotting paper, held on with some half dozen artists' thumb tacks. Of course your egg is to be blown and not show the opening. Next you decide whether or no you desire it to throw a shadow; if you do, you simply fasten it to the blotting paper with a small piece of soft wax, exposing to the camera the side you wish represented; if you do not, you insert a piece of wire a few inches long into the board and perpendicular to it, and fasten the egg to the end of it with a soft piece of wax. Place a bucket of water on the floor under the egg, in case the specimen should accidentally drop off. Focus the egg natural size and sharp on the ground glass of your camera; this may be ascertained by a pair of calipers, comparing the actual length of the egg with its image upon the ground glass. Insert your smallest diaphragm and expose, the time of exposure being governed by your former experiences. I prefer Seed's dry plates. They give excellent results. After developing, unless you get a very strong negative it is always best to intensify your plate, and this is done by the usual mercury and ammonia process. Now, if you wish an uncolored figure to be lithographed, or woodcut, or for some of the special processes, you must print on the best ready sensitized albumen paper, toning the print handsomely afterwards. On the other hand, if you desire a colored figure, you must print on plain, *i. e.*, non-albumenized, sensitized paper, and afterwards color the print by hand with Newton's water-colors from the specimen. Pure white eggs stand out well when photographed against black velvet or crape; this also applies to some skulls and other osteological specimens, when they are cleaned to a state of glistening whiteness. Such a procedure defines the outlines well for the engraver.

When we come to the photographing of birds, living birds, for the purpose of obtaining the proper kind of figures that can be used for the various methods of reproduction now in vogue, we enter upon a field where one can display no end of patience, tact, and ingenuity. It will be a long day before the writer will forget his experience in obtaining a photograph of a live screech owl. Three times I walked half a mile from the house where I could get a sky background for him on the summit of a hill, where an old natural stump was also to be found to serve as a perch for him. Just as good a result can be obtained by photographing your bird in your studio with a sheet for a background, and then you may choose any kind of perch you desire, from a museum T to the limb of a rugged old pine with the cones and spines on.

Right here, however, I desire to mention a process, no doubt already known to many, for which there is no end of use. Say you have obtained a fine, intensified negative, the subject being a bird caught in the act of some habit peculiar to it. You wish to obtain a good, strong, accurate outline figure of it, from which an electrotype can at once be made, to serve as an illustration for some article upon which you may be engaged. Make a print from the plate upon plain, nonalbuminized, sensitized paper. Remove the print to the dark-room and wash out the silver from it thoroughly. You may tone, but it is not absolutely necessary unless there is very considerable detail in your figure. Dry the print in the dark, and keep in a perfectly dark place until evening. When evening comes complete your work under a good lamp where the direct rays do not fall upon your print. Pin this latter out on a small drawing-board with artists' thumb tacks, and then with a mapping-pen (No. 291, Gillott's) and Higgins' American drawing ink carefully ink over by lines and otherwise the outlines of your figure. In doing this you will have the opportunity of making it appear just as you desire your outline ink sketch to appear when it comes to be finally printed from the electrotype. Having carefully completed your work, immerse the print flat in a tray containing a saturated solution of bichloride of mercury. This in a moment takes out all of the print except the ink outline you have traced, and this latter it leaves upon a pure white sheet of paper. Next dry the print thoroughly and mount upon a suitable card. At a small cost, a good electrotype can be made from this figure. Photographing against a sheet, of course, takes out a great deal that you do not want in your reproduced figure, but by the process just described you need not have a single point or line more than you want. It works admirably where we wish to reduce the subject to any required size; in osteological subjects and in dissections; in deformities of birds; and indeed in dozens of other cases. To naturalists in general I would say that the process just described is absolutely invaluable; by its means ready and accurate sketches are made of characters of country; of all sorts of ethnological subjects, as pottery and native arts, sometimes so difficult to draw; of complicated skeletons; of living animals of all kinds, and thousands of other subjects too numerous for enumeration.

With some live birds the following plan will be found to work well: Suspend a shelf, at the proper height, from the wall of your studio and in the proper light. This shelf, as usual, is to be entirely covered with white blotting paper, and upon its horizontal part is to be firmly fixed the limb, trunk, or rock, or turf upon which you desire your specimen to appear. Set up your camera and focus this perch sharply on your ground-glass; next put in your smallest diaphragm and attach your "pneumatic shutter" ready for instant use. Gently take your living bird in your hand, smooth its feathers, caress it for a moment or two, then quietly place its head under its wing, and by beginning slowly soon rapidly whirl your specimen in a circle. This, as it were, "put it asleep," but it will seize the perch with its feet, or rest quietly on rock or turf. Place it as near as possible in the position you desire, and stand ready for a semi-instantaneous picture. Be perfectly quiet. In a few moments your bird gradually comes to, rights himself, preens up a little, looks around, steadies himself into a natural attitude, finally looks himself, and then more or less animated. This is your chance, puff the snap on him!

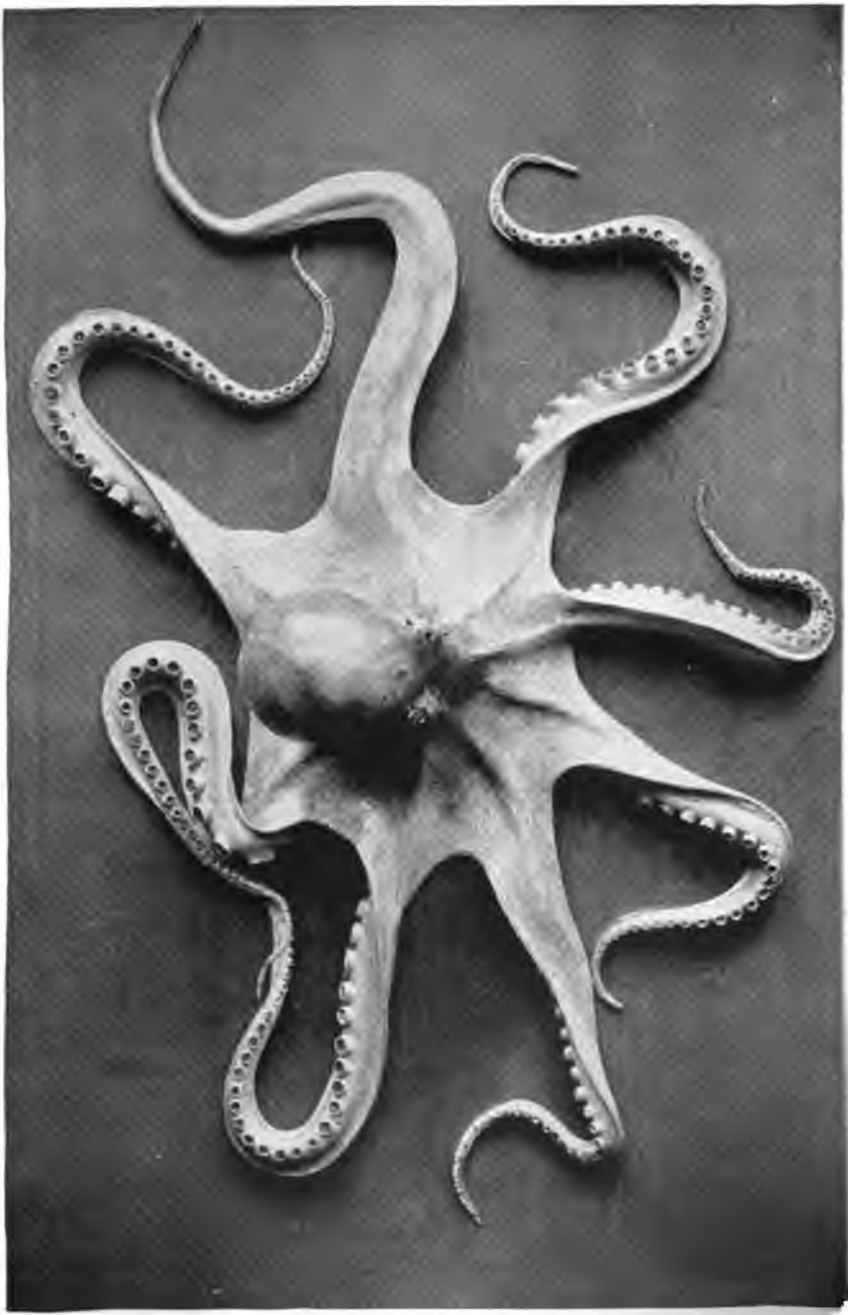
Upon reading this over I find few, if any, alterations to make, and since it was written I have succeeded in obtaining not a few good figures according to its directions, some of which are republished as illustrations in the present paper and will be described a little later. There is one thing, however, that needs notice, and in order to get a good electrotype or stereotype, it is not necessary to proceed as above given, for we can simply make a blue print; that, as we know, can be done in a few moments, and is a finished picture, *i. e.*, does not require toning and fixing. Then trace what you desire to appear on your blue print as directed, and bleach out with a saturated solution of bicarbonate of potash. This gives you a black and white drawing of any finish, according to the labor you may desire to put upon it, and is the working drawing now so commonly used for newspaper cuts; but when printed upon the best paper, for the resulting electrotype or stereotype furnishes an excellent drawing for a variety of purposes, and a very useful one for the working naturalist and practical taxidermist.

Blotting paper in large sheets makes a far better background than a sheet, and you may use it pure white, or blue, or gray, according to the effect you desire to produce. Your subject should be well in front of the background, and, if possible, so far in front as to avoid a shadow being thrown upon it. Pictures thus taken out of doors, on clear, bright days, are generally excellent.

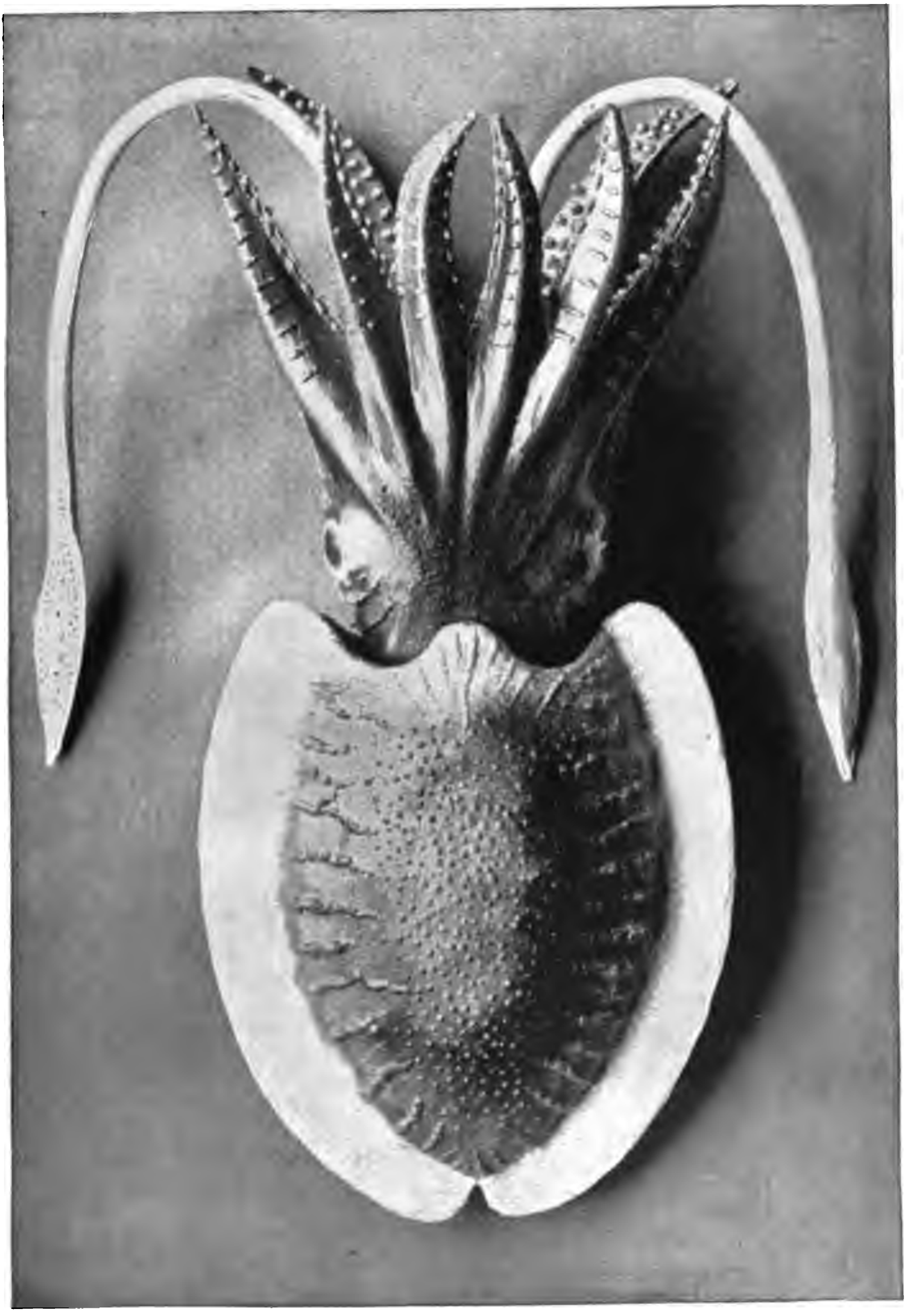
Returning now to the requirements of the skilled taxidermist, I have said, and Capt. Brown supports me in it, he should have such a knowledge of physics and chemistry as will assist him in the case of the first in deciding upon the possible and impossible in the matter of the attitudes of animals, and to some extent in the surroundings, as in the rock work, etc., now extensively used in reproducing large groups. With respect to chemistry he should be so much master of its general principles as to be enabled to practically apply it to the action and composition of preservatives for the preservation of every description of animal tissue. Not only that, but such a knowledge will be useful to him in experimenting with the preservation of many kinds of plant growths and kindred structures. For instance, I have recently been shown specimens of the leaves of some varieties of trees that had been gathered in nature and so perfectly restored that there was no very great depreciation in them, either of form or color, and the effect when properly done is most excellent.

Fruits are now frequently reproduced by the methods of the plastic cast, and are so perfect as to absolutely deceive the most critical of observers. The persimmons in the Raccoon Group in the National Museum were manufactured in that way, and it is by no means an easy task, aided by the eye alone, to distinguish them from the originals.

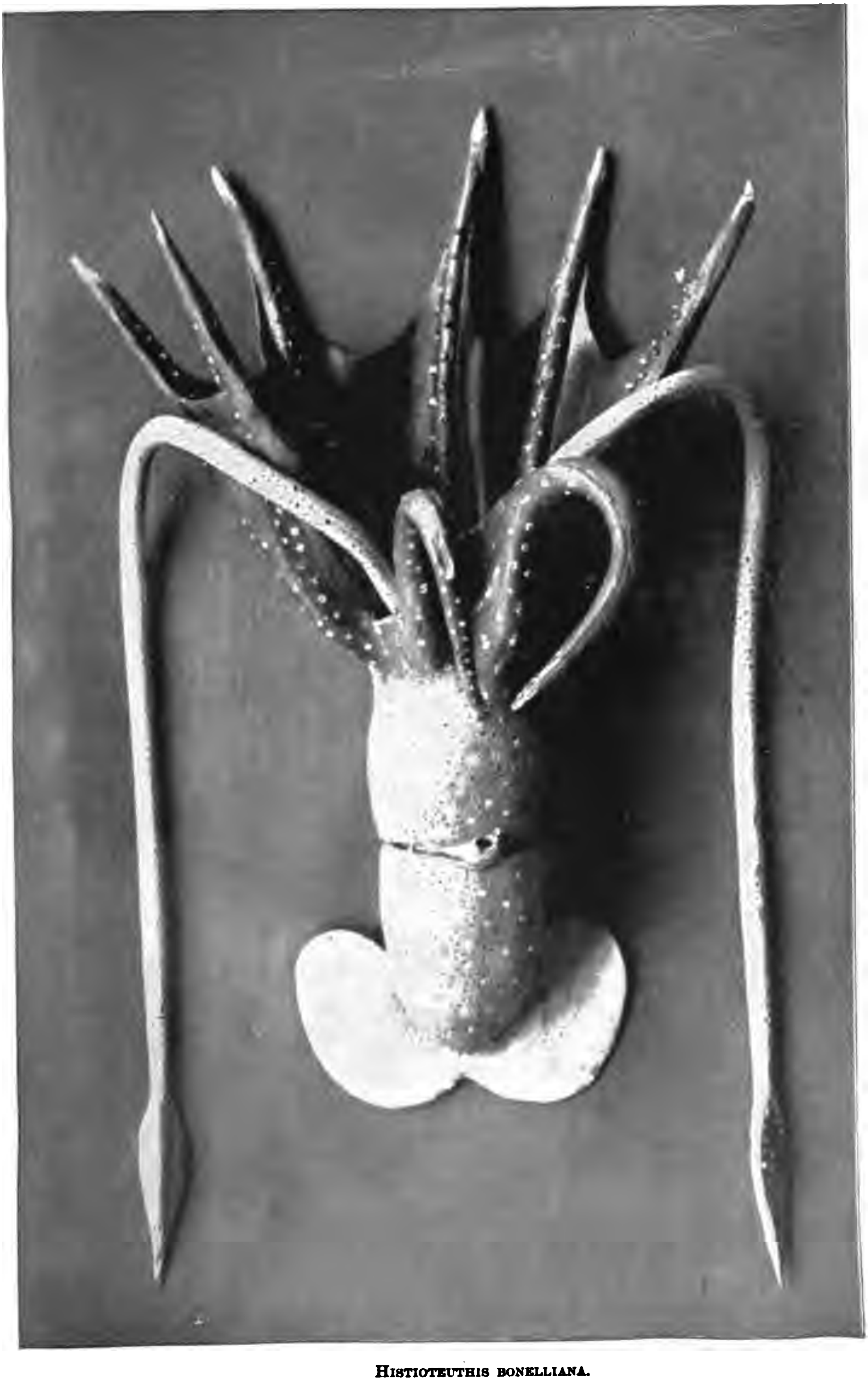
This brings us to the question of the various modes of modeling, and here is one of the branches of the taxidermic art, upon which too great an amount of skill and ingenuity can not well be expended. Here all the acquirements of the art student in taxidermy can be applied and nothing lost by the labor. It involves the application of all his knowledge of anatomy, his technique, his taste, and indeed, nearly everything which it has been recommended above for him to prepare himself in. He should be able to make casts of both vertebrates and invertebrates in plaster-of-Paris; he should be familiar with the various methods now



OCTOPUS (*Octopus vulgaris*).
From a gelatine cast; reduced.



COMMON SQUID (*Sepia officinalis*, ♂).
From a gelatine cast; reduced.



HISTIOTEUTHIS BONELLIANA.

From a gelatine cast: reduced.

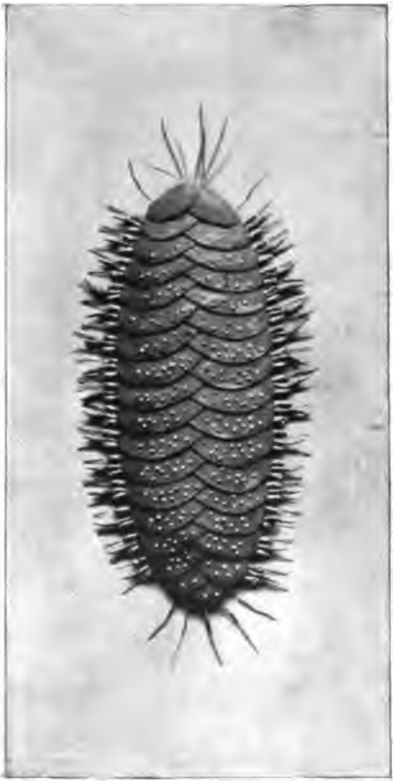


Fig. 1. *Polynoë leucohyba.*

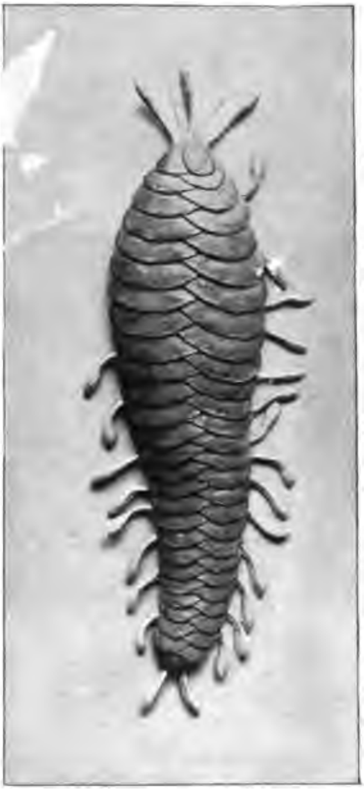
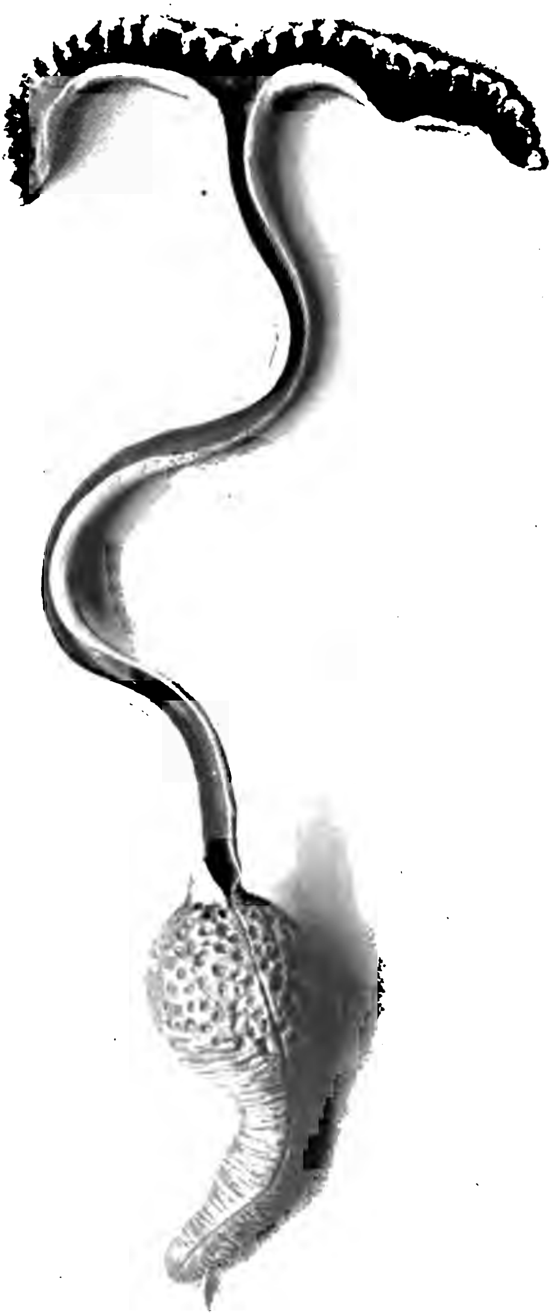


Fig 2. *Gastrolepidia clavigera.*

ANNELIDS.

From gelatine casts; somewhat enlarged.



A MARINE WORM (*Bonellia viridis*).

From a gelatine cast; greatly enlarged.

so generally in use, of the reproduction of many of the smaller animals in the different kinds of plastic material; he should be an adept in the use of clays, wax, wood, and other materials for the restoration of parts. In short, now that taxidermy is a rapidly progressing art, the advanced students and representatives of it, require, I think, no word from me here to stimulate them to keep abreast of the many improvements taking place in it. Among other things it should be the aim of taxidermists to establish in this country at least several good societies, where from time to time they could meet and exhibit the most recent successes in their art. Where papers could be read, and the work of individuals generally compared. Organization, in other words, I must believe, would at the present stage of the art's development, be a benefit.

The writer of this paper has ever been a strong advocate of the establishment of large, thoroughly equipped Government institutions of learning or universities, and of the nation's duty to educate in the best possible manner her aspirants in the different departments of science and art. What a national safeguard it would be in such a profession, for example, as medicine; what a source of stimulation to such an art as taxidermy? I weigh my words well, when I say that if such an institution could annually graduate in this country 50 thoroughly educated and skilled taxidermists, it would in time, far more heavily redound to our national credit than much else I could name which our Government indulges in. Apply it to all the arts and sciences, and we would command the respect of every nation of the globe, and, better than this, it would be that kind of respect which skill, knowledge, and culture always brings, and which brilliant display of warships, guns and warism can never inspire.

Let us pass next to the consideration of the question of some of the results now attained to by modern taxidermists in the preserving of animals for museum exhibition. Here we meet with at the very outstart, a phase of the art in which the workers at the U. S. National Museum have kept themselves fully abreast with the advances made in it. Recently some beautiful work has been turned out here, especially in the line of single specimens, as well as groups, of marine invertebrates for the World's Columbian Exposition at Chicago.

Take, for example, such an elegant reproduction of an Octopus as is shown in Plate XV (*O. vulgaris*). This triumph in the matter of an exact model, perfectly preserved, of a large soft invertebrate animal is accomplished through the use of the plaster mold, and gelatine cast, now so successfully brought to such perfection. Under the careful supervision of Mr. F. A. Lucas, whom I must thank here for the selection of the six specimens illustrating this department, the proper specimens are first picked out from the collection or are chosen from plates, and pass next in order to the most skilled modellers, casters, and colorers. Of the series I here present, Mr. A. H. Baldwin has made the models after the drawings of various artists which will be hereinafter mentioned. After a model has been made, a mold is next taken, and from it a gelatine cast is secured which later is finally trimmed to life, and faithfully colored to nature. Mr. J. W. Scollick is responsible for the delicate manipulation required in securing accurate molds and castings from the models, and then they once more pass to Mr. Baldwin's hands to be colored. After this operation and when perfectly dry, they may either be tastefully mounted upon properly tinted pieces of small boards of a suitable kind of wood, dressed down to a right thickness, or they may play their part in a group, wherein all the natural surroundings of such creatures are reproduced, save the element in which they exist. This specimen of *Octopus vulgaris* was based on the figure given by Verany, as was also the models of *Sepia officinalis*, shown in Plate XVI and in one of *Histioteuthis bonelliana*, shown in Plate XVII, and so may be relied upon as being more or less true to nature.

Unless one has seen one of these finished gelatine casts of such an animal as an Octopus, it is hard to realize what a perfect representation it gives us of the living animal; and, the cast being perfectly pliable, much as is the best of good rubber, it still further enhances the resemblance to the original. But to produce this, requires skill and art of a very high order at nearly every step of the process. In the first place, if we are to model from a drawing, that drawing must be known to be accurate; if we model from a specimen, we must be sure about placing it in a posture that the animal is known to habitually assume. Great skill is next required in making a perfect model or copy of the design or specimen, and then it goes without saying that it is only through long experience and care that the necessary molds and casts are obtained. Much depends at last upon the ability of the artist to faithfully color the result of all the previous efforts; that is, the trimmed cast. Hornaday has said in his work on Taxidermy:

> For irregular objects, the working of a gelatine mold is perfection itself. It yields gracefully in coming out of the undercuts and around corners, takes every detail perfectly, and in the jacket its shape is always the same. A careful operator can make from twenty to fifty copies of a cast in a single mold before its loss of sharpness necessitates its abandonment (p. 267).

Hornaday's brief chapter on the making of molds and casts in the volume just quoted is one of the most useful and valuable in the book.

In passing, I am tempted to say here that the Cuttlefishes to which this Octopus belongs are the most highly organized members of the class of animals constituting the *Cephalopoda*. As the *Malakia*, they were fully recognized by Aristotle over three hundred years before Christ. Of their distribution, Nicholson has said that—

> They are all marine, active, rapacious, and carnivorous in their habits, swimming vigorously by means of the jets of water emitted from the funnel, or in an opposite direction by means of fins, and creeping about the sea bottom by means of the prehensile arms. Some forms (such as the *Octopodidæ* and *Sepia*) are essentially littoral animals.

frequenting shallow seas, living in the vicinity of the land, and specially affecting rocky bottoms. Others (such as *Tremoctopus, Sepiola, Argonauta, Spirula, Architeuthis, Onychoteuthis,* etc.) are pelagic animals, living in the open ocean, often far from land, and swimming at or near the surface. Though more varied as regards their specific and generic types in the warmer seas of the globe, cuttlefishes are found in almost all seas, and are sometimes extremely numerous individually even in the colder oceans. It seems also certain that our present knowledge as to the pelagic forms is only very imperfect. As to their dimensions, none are extremely minute, and some attain truly gigantic dimensions. Not to speak of the fabulous accounts of colossal cuttlefishes given by many of the older writers, such as Pontoppidan and Olaus Magnus, we are now acquainted through the observations and descriptions of scientific witnesses, such as Banks and Solander, Quoy, and Gaimard, Steenstrup, Verrill, etc., with various huge cuttlefishes, inhabiting both the Atlantic and Pacific oceans. Some of these, though only known by imperfect specimens, certainly attain a length of 15 feet or upwards to the body and head, and from 30 to 40 feet or upwards in the long tentacles. All these giant cuttlefishes appear to belong to the suborder of the *Decapoda.**

These gelatine casts are not only accurate and beautiful objects to be placed in the cases of any museum, but they, by being kept under the protection of glass doors, will last for almost an indefinite length of time, unaltered in color or form. The range of the applicability of the gelatine cast is well-nigh infinite. I have seen fish, frogs, serpents, lizards, and similar animals thus reproduced, and so perfectly that their faithful portrayal of the original subjects was truly marvelous. As to fruit of all kinds, it can be imitated so closely that sometimes, by the aid of the eye alone, one can not correctly decide between the original and the copy thus made.

For the presentation of form, color, and general character, such reproductions of animals as the common Squid, shown in Plate XVI, and the *Histioteuthis*, shown in Fig. 4, leaves but little to be desired along such lines. No one can for a moment doubt but what a great deal is to be hoped for from this department of animal preservation, and the encouragement of it is to be most highly recommended.

Other fine successes in this direction are shown in Plate XVIII, Fig. 1, Plate XVIII, Fig. 2, and Plate XIX. Plate XVIII, Fig. 1, of a specimen of *Polynoë leucohyba* (somewhat enlarged), and likewise the *Gastrolepidia clavigera*, shown in Plate XVIII, Fig. 2 (somewhat enlarged), are from Schmarda, both being very instructive representations of the originals. As is known, these low forms belong to the *Annelida*, each being genera in the order *Polychæta* of that group.

Another beautiful reproduction of an interesting annelid is shown in Plate XIX. This is also from a photograph of the gelatine cast in the collections of the U. S. National Museum and represents a specimen of *Bonellia viridis* of the Mediterranean Sea. It is greatly enlarged, and the model based upon the drawing given us of this form by Lacaze-Duthiers, who has rendered an account of this marine worm in a paper entitled "Recherches sur La Bonella (Bonellia viridis)." (Ann. Scien. Nat., tom. x, Paris, 1858, pp. 49–110, Pls. 1–4.)

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* Nicholson, H. A. Art. "Cuttlefish." Encyl. Brit. 9th ed. vol. VI., pp. 739, 740.

Such annelida as *Bonellia* represents belong to the order Gephyrea, and, according to W. C. McIntosh, "seem to approach the Echinoderms through the Holothuroidea." They are all marine types, being very widely distributed throughout nature, specially in muddy regions, some being frequently found in univalve shells.

By such representations as these, and by the judicious use of explanatory tables, surely the museum of the future has a fine field to look forward to, for such an art as this is capable of classifying in cases, according to natural taxonomical schemes, whole groups of animals, that heretofore have been studies only from the specimens and from plates and drawings. It also admits of similar casts, duly colored, of the anatomical structure of these little popularly known types, and, as I have already said above, of placing many of them in their cases surrounded by reproductions of the objects of their several environments in nature.

Passing next to the art of taxidermy as applied to crustaceans we are confronted with an entirely different problem than the one of which we have just been speaking. And, as the writer has had no personal experience of the kind, it is with no little pleasure that I find a brief but able article on this subject by my friend Mr. F. A. Lucas, and from it I here quote such parts as are in keeping with the present paper, by which I mean that the outstanding difficulties will be indicated while the technique of the art will be omitted.

Lucas has said:

> Mounting of crabs, lobsters, and other crustaceans is somewhat of a thankless task, requiring an outlay of considerable time and trouble to arrive at results at all satisfactory. At first sight it would seem an easy matter to mount an animal whose form is determined beforehand, but a little trial develops the fact that, like bringing up children, it is much easier in theory than in practice. As crustaceans dry they become very brittle, and the small legs and delicate feelers break only too readily. Worse than all, the beautiful colors with which these creatures are adorned while living fade rapidly, and the only way in which they can be renewed is by a dextrous use of paint. Therefore the great requisites for mounting crustaceans are a careful touch, a good eye for colors, and some knowledge of the proper methods of applying them. The preparation of crustaceans is a little peculiar, inasmuch as, instead of the skin being removed from the body, the body is removed piecemeal from the skin. * * *
>
> * * * Crustaceans may be mounted either on plain pedestals or on artificial rock work, according to the purpose they are to serve, and in any case they should be kept out of the dust as far as possible, since, owing to their fragile nature, they are very difficult to clean.*

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* On the Mounting of Crustaceans. Third Annual Report of the Society of American Taxidermists, pp. 74–77, 1882–'83. As it is a fact quite as well known to every one interested in the matter as it is unfortunate, that The Society of American Taxidermists no longer has any existence, I will here make a bibliographical note of the two former reports of that society for the benefit of those who may desire to con-

In time we must believe that the plastic method as described above for invertebrates will come to be generally used for crustaceans as well. There is no reason that I can at present see that it should not, and every reason that it should. No specimens of the group preserved in that way have come to my attention in the collections of the National Museum or elsewhere, and so I have no plates of the same to offer here. Those prepared by the methods recommended by Mr. Lucas are so well done, and differ so little or not at all from those animals as they are recognized by us in nature, that nothing would be gained by reproducing photographs of them as illustrations to the present report; therefore the idea was not entertained.

This fact has also influenced in regard to insects; moreover, in the case with that group our Government has already published very full instructions upon their mounting and preservation for museum purposes, and that taxidermist who aspires to be a master of every department of his art can do no better than consult the admirable treatises of Prof. C. V. Riley, and of Prof. A. S. Packard, and others in the same field.

When we come to fishes, however, we at once enter upon the borderland of the taxidermy of the great realm of the vertebrata, and for it there exists a not inextensive literature, and methods and instructions are found almost without end.

Fishes seem to have constituted the *bête noir* of the museum collector and the taxidermist for ages past, and until the use of the gelatine cast came into vogue their natural preservation seemed almost hopeless. In alcohol many of them become shrunken, and a large percentage part with their natural colors entirely. Moreover, the usual cylindrical jars used to exhibit them in, on the museum shelves, so distort their forms to the eye of the casual observer who thus views them through the glass, that another serious disadvantage is added. To a large extent, this has recently been overcome by Mr. J. E. Benedict, of the National Museum, who, by indefatigable patience and thought, has devised very neat appearing glass receptacles, with plane surface sides, and a few ingenious devices for sustaining the contained specimens in more natural positions, thus largely doing away with the aforesaid disadvantage.

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sult them in the future. I am indebted to Mr. Lucas for the loan of them, and they are works of no little interest. They are as follows:

First Annual Report | of the | Society | of | American Taxidermists. | — | March 24th, 1880, to March 25th, 1881. | — | Rochester, N. Y. | Daily Democrat and Chronicle Book and Job Print, 3 West Main st. | 1881. 8vo., pp. 36. 3 process plates.

Second Annual Report | of the | Society | of | American Taxidermists. | — | March 25th, 1881, to March 24th, 1882. | — | Compiled by the secretary. | — | Rochester, N. Y. | Judson J. Withall, Book and Job Printer, 39 N. Union street. | 1882. 8vo., pp. 56, with an announcement and index. 2 plates.

It is very much to be desired that this society should be reorganized, and that upon a basis of organization of some one of our best societies in the arts or sciences. The need for such a society is great.

Still, where alcohol is the preservative used, there yet remain the loss of color and the distortion due to shrinkage. Many authors in the art of taxidermy have suggested in their works from time to time various plans for the skinning of fishes, and "stuffing" them much in the same way that birds and mammals are done. But as a rule, failure of greater or less. degree is generally the outcome of all such attempts. I have studied collections of stuffed fishes in many parts of this country and elsewhere, and I yet have to meet with one in any museum or private collection, that comes up to what it ought to be. We turn from the cases of such objects with feelings of anything but a pleasurable nature. We hear a great deal said about the beauty of birds, and they are beautiful, but I, for one, see a beauty that is quite equal to it in the vast majority of fishes. Where has nature a lovelier object to offer for our admiration than a finely marked adult speckled trout just as the fellow is pulled out of his natural element and lies in the bright rays of the sun, panting upon a grassy bank? And, do we ever see anything that very much resembles his incomparable charms in our miserable dried-up collections of "stuffed" fishes? Hornaday has said:

> Certain it is that in nearly every large zoölogical museum the stuffed fishes are the least attractive, and the least lifelike of all the vertebrates. In many instances the reptiles are not far behind in unsightliness, although, as a rule, they are a little more lifelike than the fishes. In only one natural history museum out of twenty-seven have I found a collection of stuffed fishes which surpassed in number and quality of specimens the collection of birds and mammals, and formed the most attractive feature of the entire museum. That fish collection is to be seen in the Government museum at Madras, India, and I have reason to believe it is at present the finest of its kind in existence. The collection consists of a very general assortment of specimens from the Indian Ocean, and particularly from the Coromandel coast, and besides a large number of small specimens it also contains as many large sharks, *Rhinobatidæ,* and rays as the authorities have been able to obtain without duplicating the species.
>
> The specimens were all mounted while fresh from the ocean, which, of course, has been a great advantage to the taxidermist. I was somewhat surprised to learn that the taxidermist in question was an Indian native named P. Anthony Pillay, because East Indian natives of all classes are almost without exception very bad taxidermists. Upon being introduced to Mr. Pillay, an old Mohammedan gentleman with a long white beard, dressed in the style of his class, he very obligingly explained to me his method of mounting fish of all kinds.*

Personally, I have but little or no confidence in cultivating the art along on these lines, notwithstanding the measure of success attained to by the Indian taxidermist just mentioned. For all large zoölogical museums I believe that experimentation should proceed in the direction of discovering, if possible, some clear, transparent, preservative fluid that will not change the form or color of the specimens, and then exhibiting them in such positions as we would see them in aquaria and such tanks containing living fishes as are to be seen at the exhibi-

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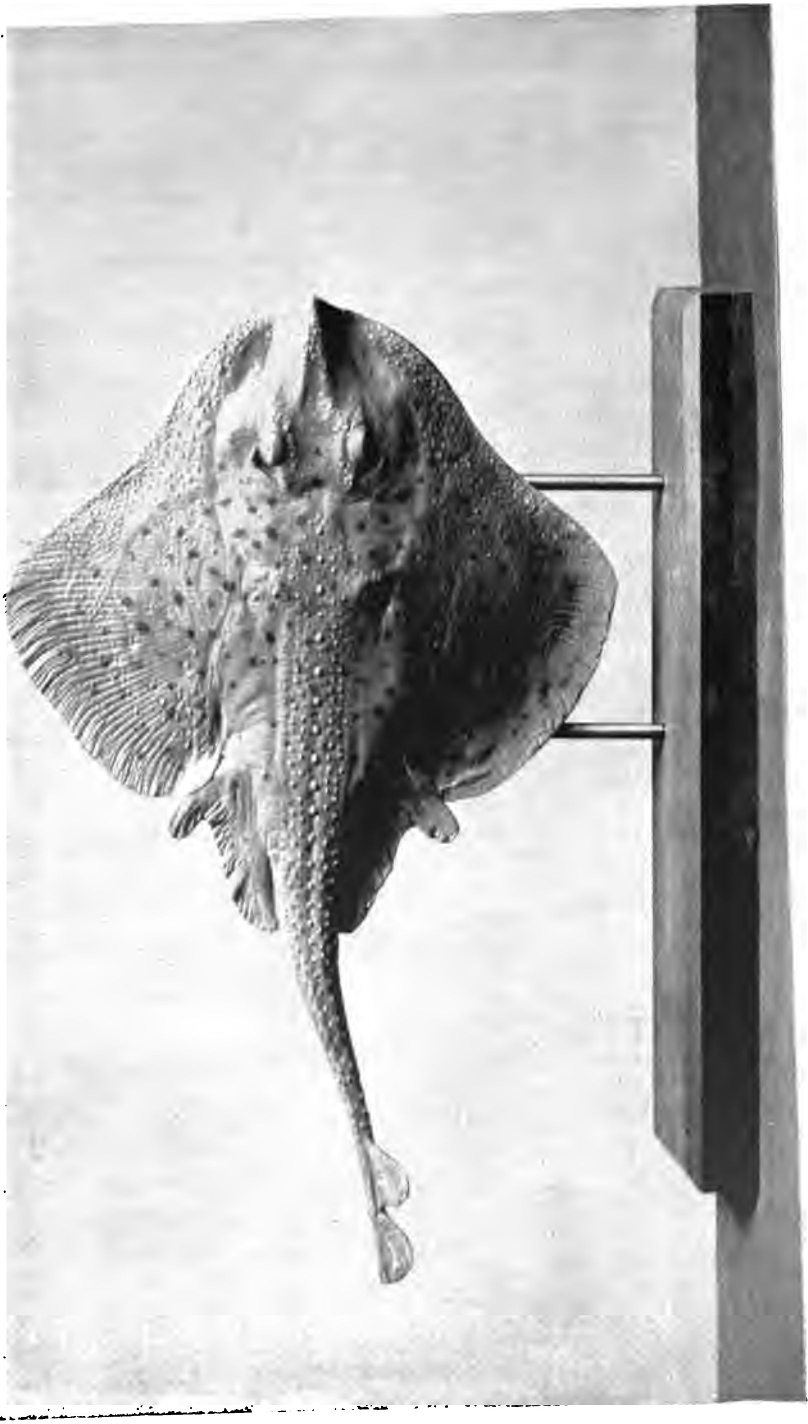
* Hornaday, W. T.: A New and Easy Method of Mounting Fish Medallions. Second Ann. Rept. Amer. Taxidermist, 1881-'82, p. 38.



SKATE (*Raia erinacea.*)
From a plaster cast; greatly reduced. (Cat. No. 16508, U. S. N. M.)

tion room, the grottos, of the U. S. Fish Commission at Washington, D. C. Mr. Benedict, no doubt, has the correct idea in regard to the form of the receptacles that should contain them, and that is a very important step in advance. Added to this, the taxidermic artist has a beautiful field open to him in his method of making plaster casts and casts of gelatine, upon both of which he may exert his utmost powers and ability to color so as to have them resemble the natural fish as closely as possible, and I mean the natural fish immediately after he has been removed from the water and wiped dry. The study of the proper colors alone is in itself a vast subject, for they must not only counterpart the natural shades of the specimens, but they must be selected with the view to their permanency and general effect. Various methods of gilding and silvering upon plaster-of-Paris, gelatine casts, and papier-maché ones require careful research and consideration, as by their use many admirable results are to be obtained.

As to the large cartilaginous fishes, as the rays, sharks, and their kin, we must believe that the processes just referred to are at present the only ones known to us by which the living specimens can be reproduced with any marked fidelity to nature and fit for a first-class museum.

By the old fashion "stuffing" method, it seems quite out of the question, even for the most skilled taxidermists among us, to succeed in thus preserving a shark's skin, or that tissue in the troublesome ray. They will not resist the effects of time. They shrink, become distorted, and finally burst, and bring only failure and disrepute upon the art. One may as well try and stuff a soap bubble, and fortunately there is no necessity for either experiment.

In his usual vigorous style, the artist I have last quoted, remarks:

> Rays are the meanest of all subjects that vex the soul of the taxidermist. Shun them as you would the smallpox or the devil. Such abominable animated pancakes, with razor edges that taper out to infinite nothingness, were never made to be mounted by any process known to mortal man. To mount the skin of a vile ray, and make it really perfect and lifelike, is to invite infinite shrinkage, rips, tears, warps, defeat, and humiliation at the hands of your envious rivals. If you must mount a ray, by all means get square with it at the start. Stuff his miserable old skin with tow or straw, the more the better. Ram him, cram him, "full to the very jaws," like the famous rattlesnake skin that taxidermist Miles Standish stuffed "with powder and bullets." If you can burst him wide open from head to tail, by all means do so, and you may call me your slave for the rest of my life. Make him nice and round, like a balloon, and then no matter what he does afterward to mortify and disgrace you, and to drag your fair standard in the dust, you will always have the satisfaction of knowing you are square with him.
>
> Once when I was young and innocent, I encountered an enormous ray. He was not thrust upon me, for I achieved him—and my own ruin also—at one fell stroke. I mounted him willingly, nay, eagerly, as Phaeton mounted his chariot, to show the rest of the world how all rays should be done. I mounted his vast, expansive skin over a clay-covered manikin that had edges like a Damascus razor, and I made him flat. He was flat enough to navigate the Platte River at low water, which even a thick shingle can not do. He was lifelike and likewise was a great triumph. But almost the moment my back was turned upon him forever, he went back upon me.

> I had put him up to stay put, so far as my part was concerned, so he just got mad and literally tore himself to tatters. He became almost a total wreck, and to make my defeat a more genuine and unmitigated crusher, Prof. Ward sent word to me, all the way from Washington, that he would sell me that large ray for $5. I never forgave him for that.
>
> The best way to mount a ray is to make a nice plaster cast of it, paint it, and then bury the accursed ray in a compost heap. As a class these fishes are remarkable, and highly interesting, and there is a far greater variety of them than anyone who is not an ichthyologist might suppose. To me there is no other group of fishes more interesting, and, I may add, there is no other group that is, as a general thing, so poorly represented in museum collections. They exhibit all possible intermediate forms between the ordinary shark and the perfectly round, flat ray. The intermediate forms, *Rhinobatti* and *Rhamphobatis*, are naturally really the most interesting.*

Some very fine plaster-of-Paris casts of fishes of all kinds are to be found in the collections of the U. S. National Museum, but as has just been remarked, for some reason or other the rays are but meagerly represented. These fishes, however, cast beautifully in plaster, and their colors are not difficult to imitate. It would be hard, for example, to find a more fitting specimen for museum exhibition than the plaster cast of the skate shown in Plate xx of the present paper. The plastic method also reproduces them with even greater fidelity, and it has the advantage of not being near so easily injured or broken. So perfect are these two methods that I will warrant that were we to take the living skate, the gelatine and plaster casts, make photographs of them all of the same scale and under the same conditions as the one seen in my plate, we could only with the greatest difficulty distinguish among them.

Not only is it possible to reproduce life-like representations of living fishes by means of the plaster-of-Paris cast, but to a certain degree we can also, by the same means, show some of the habits of this interesting group of vertebrates. A fine example of this is seen in Plate xxi of this report, wherein we are presented with a most excellent cast of a shark (*Carcharhinus obscurus*) to whose left side has attached itself a Remora (*Echeneis naucrates*), a habit this parasitic fish is habitually addicted to, as is well-known. This fine piece of work, done by Mr. Joseph Palmer, of the museum, has been colored very closely to imitate life, and is not only a most interesting and instructive object to have on exhibition in any zoölogical museum, but leaves but little to be desired in the matter of conveying a correct idea of the form and general appearance of these fishes, and in a method at once practical and, with care, enduring. The mode of mounting such specimens is also seen in the figures in the plates, and it probably can not very well be improved upon, consisting as it does of two strong metal upright standards of the proper length, and which are embedded below in the horizontal base or stand of wood. This latter may be either plain pine, painted black and heavily varnished, or it may be of any of the dark, hard

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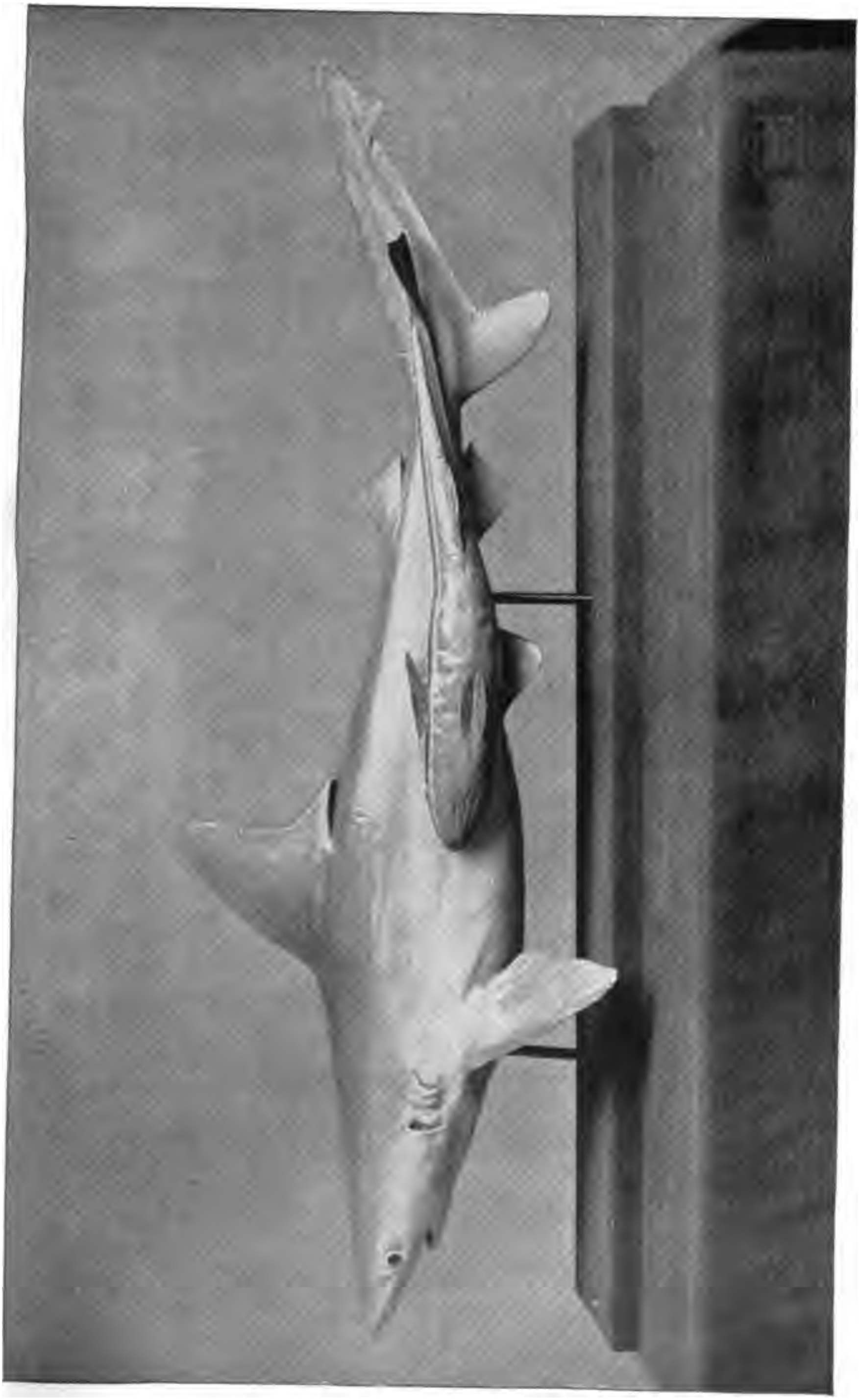
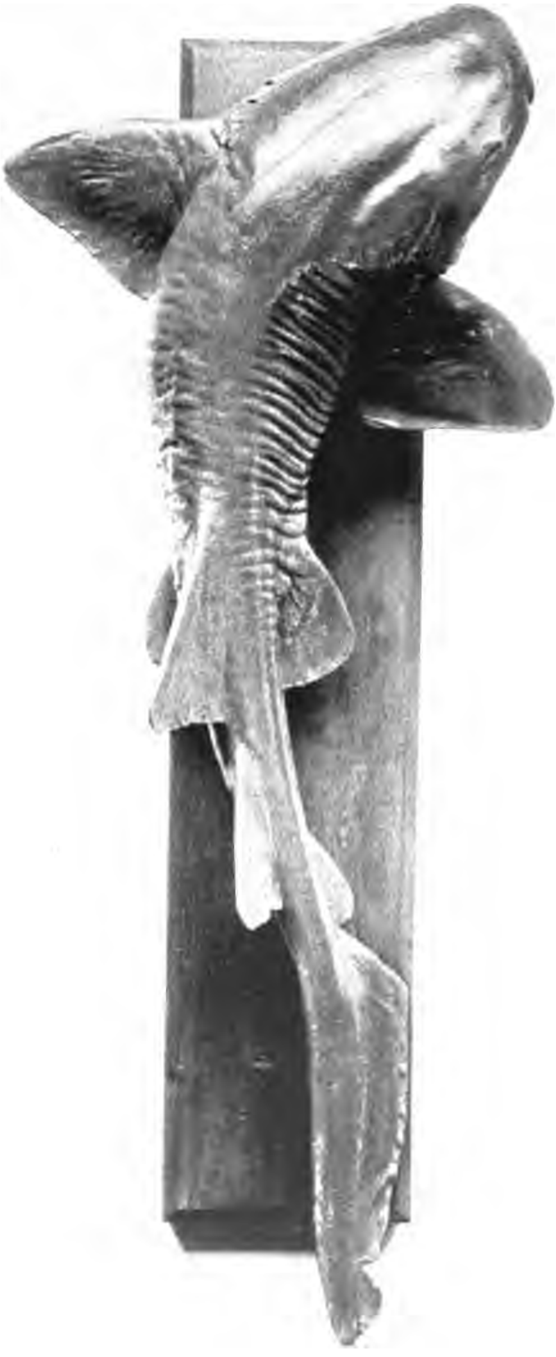
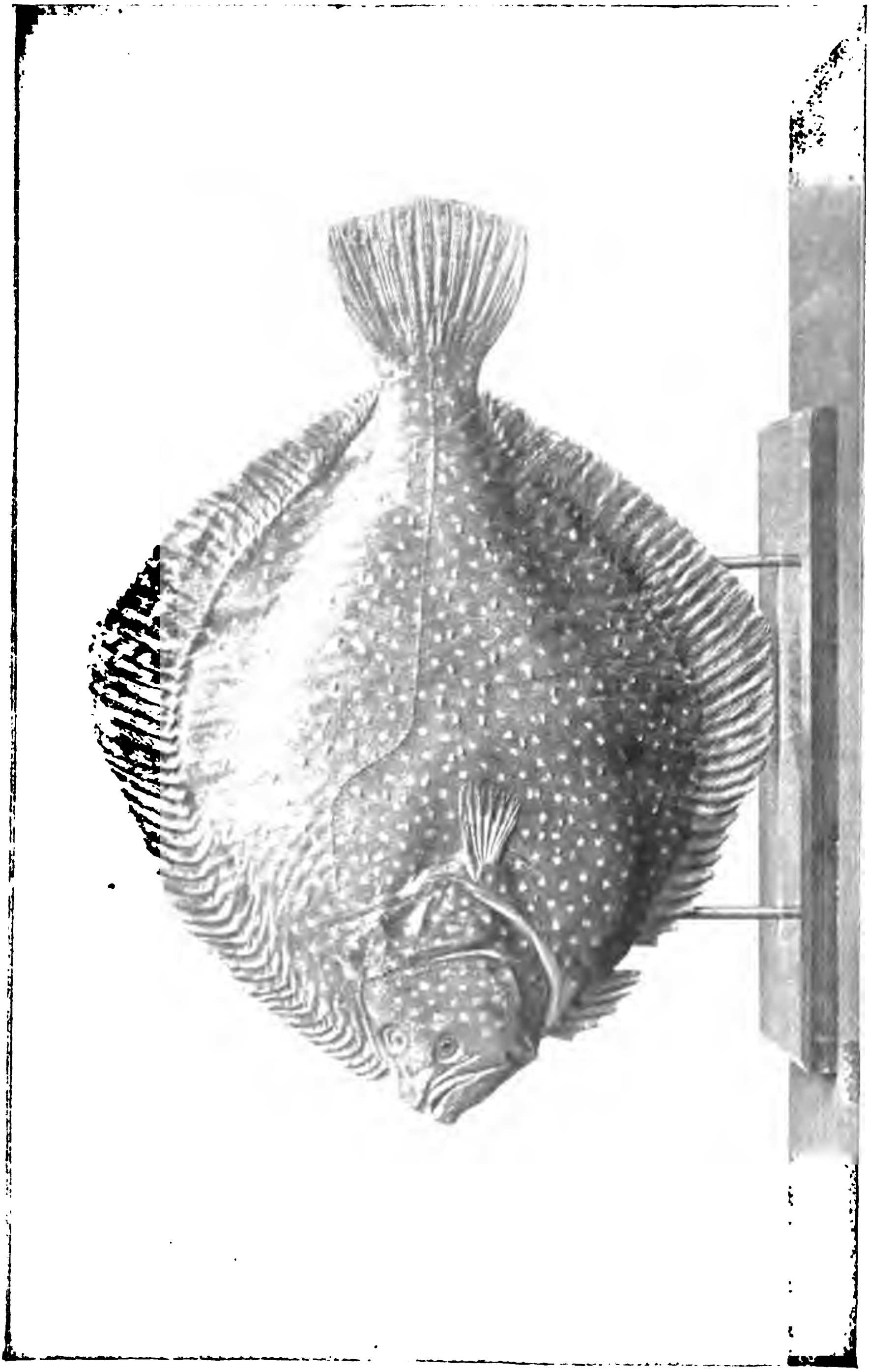
* Taxidermy, pp. 215, 216.



SHARK (*Carcharhinus obscurus*) **AND REMORA** (*Echeneis naucrates*).
From a plaster cast; greatly reduced. (Cat. No. 16070, U. S. N. M.)



NURSE SHARK (*Ginglymostoma cirratum*).
From a plaster cast: greatly reduced. (Cat. No. 16909. U. S. N. M.)



TURBOT (*Rhombus maximus*).
From a plaster cast.

woods highly polished. In any event the aim should be to have it all of a pattern and kind throughout the museum for subjects of one class, as these fishes. It admits placing the label adopted by the museum in front and in the center below, which may be attached in various ways, or simply fastened to an obliquely cut block of wood, finished in the same style as the base, and left to rest free upon it. It is important that the base should be as long, or nearly as long, as the specimen it supports, for that not only lends an appearance of good balance and symmetry to the whole, but it also is a great safeguard against the cast being accidentally tipped over and broken, or broken by the specimen projecting out beyond it too far, and so not properly protecting it.

The Remora shown in Plate XXI is at once recognized by the black stripes down its side and the white corners to the caudal fin. It seems to attach itself principally to the sharks, thus differing with its congener of the ocean (*Remora squalipeta*) so frequently found adhering to the sides and bottoms of ships at sea, well below their water line.

Another fine cast of a shark (*Ginglymostoma cirratum*) also in plaster, is seen in Plate XXII, and viewed upon superior aspect. This not only gives an absolutely correct idea of the animal it was taken from, but shows very well the peculiar lateral corrugations of the skin, so characteristic of this and other species.

Of the Teleosteans I am enabled to present in my plates quite a number of interesting and well-known forms, and if the methods of casting in plaster-of-Paris and plastic compounds be so successful in the case of the cartilaginous fishes, it requires nothing to be said that it is equally applicable to them.

All of the casts of the specimens here offered are from the collections of the National Museum, and the perfect manner in which they are done is well exemplified in the specimen of the turbot shown in Plate XXIII (*Rhombus maximus*). Most, if not all of them, were executed by Mr. Joseph Palmer with the assistance of his son, Mr. William Palmer, under the supervision and direction of some ichthyologist of the museum's staff, and skillfully colored by Mr. A. Z. Shindler. Among the principal points to be looked to in making such casts is (1) the selection of as perfect specimens as possible, especially in the matter of unmutilated parts, as fins and tail, and structures of the head; (2) the parts should be exhibited in a natural manner or properly spread out; (3) the cast so made as to exhibit special characers; it should be colored true to nature in a way already indicated; and, (5) finally, they should be well mounted, labeled, and exhibited in a closed glass case.

Later on we shall see that fish do not require in these matters quite as much knowledge, care, and study as do the reptiles; still they require a good deal, and it should invariably be bestowed upon them.

More or less uniformly colored, and comparatively smooth fishes, show up fully as well as those with many salient characters, and this is well seen in such an example as the common Pompano (*Trachynotus carolinus*) of Plate XXIV, Fig. 2, which gives a most complete idea of this interesting species. In most of these specimens the ventral fins, it will be seen, have, before casting, been brought up so as to be in contact with the body of the fish. This is done with the view of giving them the support of the latter and thus greatly decreasing the danger of having them broken off either through subsequent handling of the cast or otherwise.

Plaster casts of fishes also admit, in some cases only, of having the proper kinds of glass eyes inserted in them after the cast is made; or some special structures added, as the barbels of certain species, or spines of great delicacy, or hair-like appendages—these structures being composed of some other material than plaster, and being painted and made to naturally harmonize with the specimen as in life. This is rarely, if ever, necessary in the case of those fishes cast in gelatine or similar plastic compounds. This feature of the work admits of no little skill and knowledge on the part of the caster and painter of these vertebrates. Nothing should in any event be omitted that will lend a true and life-like appearance of the original specimen, and very encouraging progress is being made along such lines.

Another excellent plaster cast of a fish is seen in Plate XXV, taken from a specimen of the Mirror carp (*Cyprinus carpio*), a fish with an interesting history in this country now, and which, among other characters, is at once recognized by having "extraordinarily large scales which run along the sides of the body in three or four rows, the rest of the body being bare."

A fine cast is also shown in Plate XXV, fig. 2, it being the Buffalo fish (*Itiobus urus*).

It is needless almost to invite attention here once more to the fact of how well these casts here represent the forms as they appear in life. The red fish or bass of the Southern States (*Sciæna ocellata*) has also been cast, and a fine example of it exists in the collections of the Museum. Where a fish has strong and pronounced external characters, such as large scales, large projecting rays to the tail or fins, and marked characters of mouth or operculum, they are sure to constitute one of the most favorable varieties of fish to cast in plaster, and they, when skillfully painted, make some of the most striking specimens among a collection of such objects. This may be appreciated by an examination of the cast of the Parrot fish (*Scarus* sp.?), shown in Plate XXIV, or to nearly an equal extent in the one of the Trigger fish (*Balistes caprisens*), a specimen of which is to be found in the Museum's collections; and as for the reproduction of color markings, we see a good example in the cast of the well-known Mud fish (*Amia calva*), to which Plate XXVI, Fig. 2, of this paper is devoted.

We have already alluded to the use of the plastic method of casting for fishes, and so far as my personal investigations have been directed

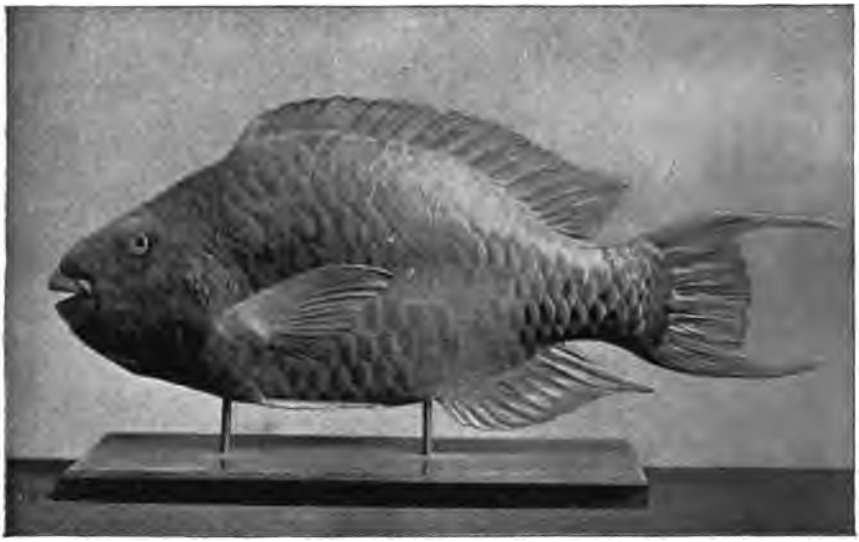


Fig. 1. PARROT-FISH (*Scarus* sp. ?).
From a plaster cast.

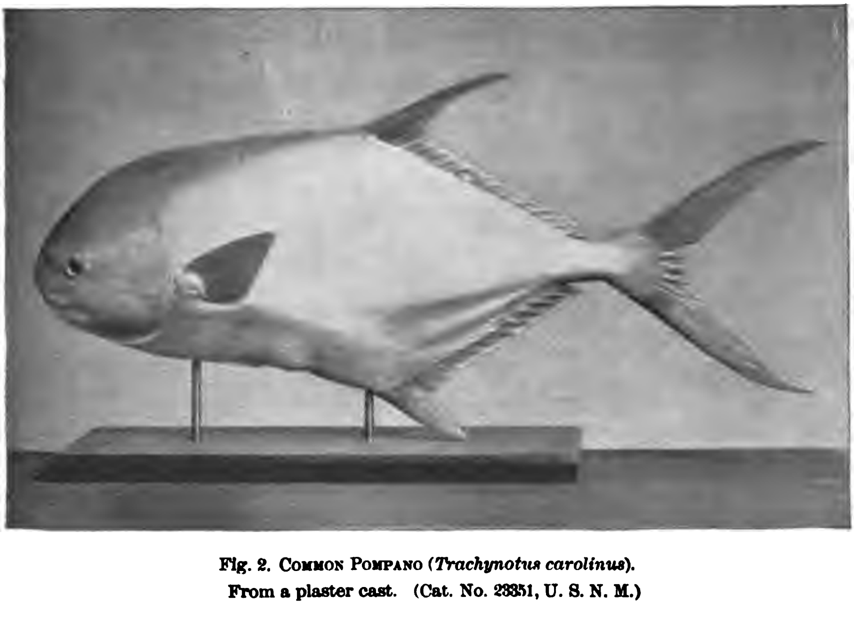


Fig. 2. COMMON POMPANO (*Trachynotus carolinus*).
From a plaster cast. (Cat. No. 23351, U. S. N. M.)

they have been concerned principally with the work of that nature done by the U. S. Fish Commission, much of which was accomplished with the view of having it exhibited at the World's Columbian Exposition. In this connection my thanks are due Dr. Tarleton H. Bean for the use of a series of photographs of the results of such methods and other processes. These, unfortunately, with the single exception of the Opah, were taken too small to be used here, and as the originals had been forwarded to Chicago, it was too late to have them photographed of a larger size. My thanks are also due to Mr. Denton for his kindness in showing me his method of reproducing specimens of fish and reptiles by the plastic method from casts made in plaster, and for submitting to me for examination specimens of his work after they had been painted and prepared for final exhibition. It would be difficult to overestimate the value of this kind of work, and the field is a broad one, full of importance and interest to the art student in taxidermy.

Specimens of many species of fish made according to such processes bear very close resemblance to the living types, so much so that photographs of the two are scarcely to be distinguished. This may best be appreciated by an examination of the specimen in the U. S. Fish Commission, or the reduced photograph which that institution has of the plastic cast of the Opah, from a specimen taken upon our own coasts. Its peculiar form and high coloring rendered it a specially fine subject for the skill of the person who reproduced it. Ichthyologists have always expressed great interest in this member of the finny kingdom, and if the digression be not considered too great, I will quote here what Mr. Goode has said of it in The Fishery Industries of the United States (p. 335). According to this distinguished authority, the Opah family, or the *Lampridida*, " is represented in the Atlantic by a single species, *Lampris guttatus*, a pelagic fish, which appears to be more abundant in the deep waters of northern seas than elsewhere. It has been observed at many points upon the Norwegian coast, about Iceland and Madeira, as well as in the Mediterranean, but is of unusual occurrence everywhere, except perhaps about Madeira. On the coast of England it is one of the great rarities, and is much sought for by collectors on account of its beauty. It is said to be one of the most brilliantly colored fishes known—'red and green, with tints of purple and gold dotted over with silvery round spots. Iris of the eye is scarlet, and fins of lively red.' A specimen was obtained years ago near Sable Island, Nova Scotia, and the species will doubtless be found still nearer our shores. It is said that no young specimens have yet been seen. The species attains the length of 4 feet and more, and is said to be very excellent eating."

Everything that has been said above in regard to the various methods employed in times past, as well as at present, for the preservation of fishes for exhibition in zoölogical museums and elsewhere applies with equal truth to reptiles. The day has apparently fully arrived when the advanced student of taxidermy will no more think of employing the old time-honored methods of stuffing a frog or a snake or a tortoise than he would of mummifying a bird—a practice that was formerly recommended, it is said, to avoid the apparent difficulty of removing the skin. Of all the effigies, I think, in the forms of bad taxidermy that have figured in such nightmares I have suffered from, or in my waking dreams, the various stuffed snakes I have seen certainly take the palm. They have been enough to frighten clean out of existence one laboring under an attack of *mania a potu*, as well as the reptiles one claims to see upon such an occasion. It is almost impossible to remove the skin from any kind of an ordinary snake without disastrously disturbing its delicate scales and their beautiful arrangement. And, as for the "stuffing" of frogs, why that may be left to those lovers of the "grotesque in taxidermy," for surely such feats have no place in a scientific museum, and it has always been a wonder to me how they ever could claim even a smile from a thorough naturalist, let alone words of praise.

My meaning in these premises will be made perfectly clear by turning to Plate XXIX, Fig. 2, which is from an excellent photograph of a specimen of Gould's monitor (*Monitor gouldi*) now in the collections of the U. S. National Museum.* This favored representative of the taxidermy of a past decade, formed a part of the South Australian exhibit sent to the Centennial Exhibition, at Philadelphia, in 1876, and subsequently, presented to the Institution, where it now is. To the enlightened taxidermist my saying it is a stuffed lizard would be all sufficient, but I fain would invite attention to the absolutely impossible attitude it has been compelled to assume. It is nailed to the base with coarse pins, whose heads show on the top of every individual foot. The hind feet are rammed to a bursting point—the forefeet are empty. To save length of stand the tail has been forced round to the side, and the toes are alternately pointing to the four quarters of the globe. We do not pass favorably upon that kind of work any more, and the only interest it has for me is the stage it represents in the growth and development of the art of taxidermy, though it is a comfort to know that the day for such ridiculous productions is rapidly passing into history.

By whatever method done, the casting of most reptiles has one great advantage over the casting of most fishes—an advantage to the extent of exercising a greater skill and knowledge on the part of the operator, for it must be easy for one to realize that to make a plaster mold of a flounder and a plaster mold of a frog are two very different matters. The first, beyond a spreading of tail and fins, requires but little arrangement, whereas in the case of the second I have met with many a person who could not for the life of him place a dead frog in a natural attitude, to say nothing of making one ready and obtaining a plaster mold of it. Lizards are sometimes still worse. It is now, then, that we come to a point where good photographs, good

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*Catalogue No. 8896.

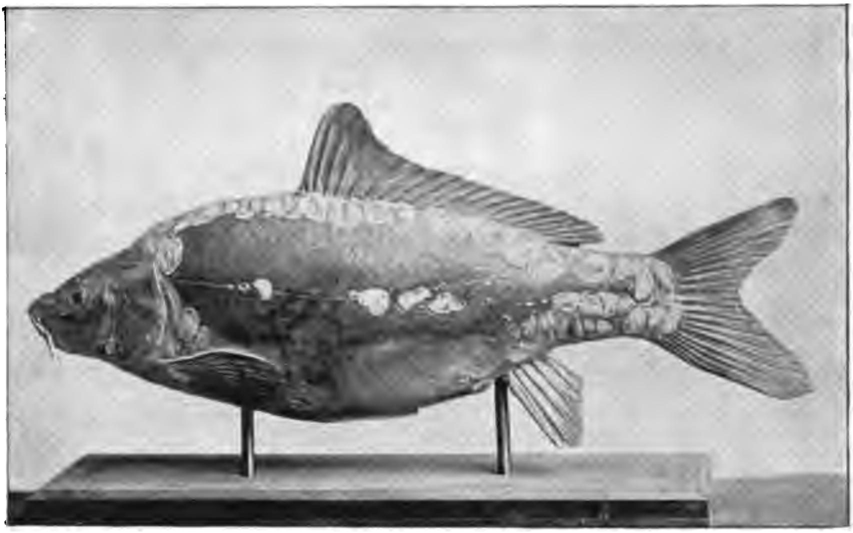


Fig. 1. MIRROR CARP (*Cyprinus carpio*).
From a plaster cast; greatly reduced. (Cat. No. 25257, U. S. N. M.)

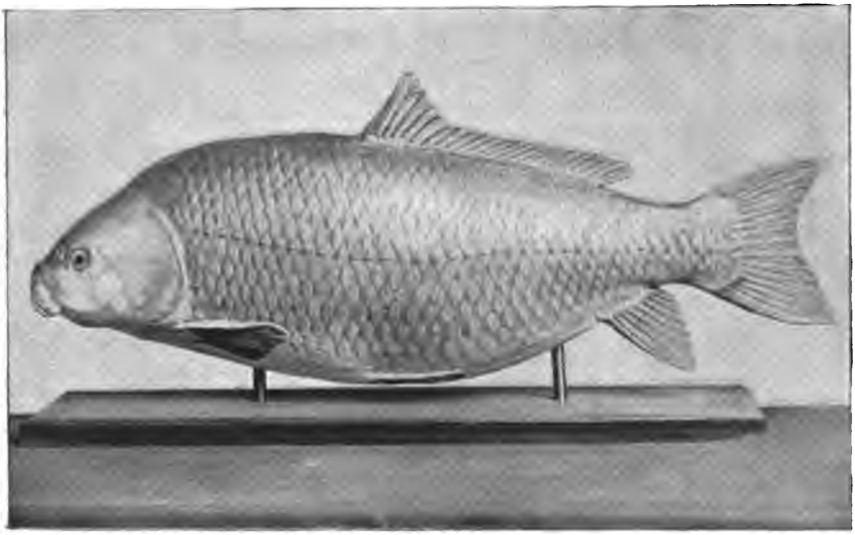
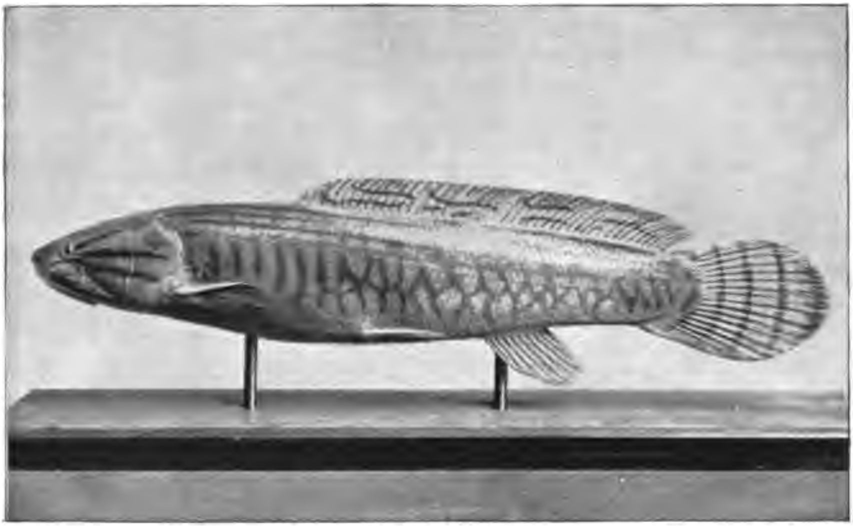


Fig. 2. BUFFALO-FISH (*Ictiobus urus*).
From a plaster cast; greatly reduced. (Cat. No. 23558, U. S. N. M.)



THE MUD-FISH (*Amia calva*).
Plaster cast. (Cat. No. 20776, U. S. N. M.)

models, and good illustrations in the vertebrate series really first come into play. It is only the exception among fishes that such necessary adjuncts elsewhere will be found useful. One would hardly think of looking for a model to make a cast of a "Needle Gar," for instance; he might in the case of such a form as the Goosefish (*Lophius piscatorius*); whereas in the case of an attacking Cobra, or some of the winged or frilled lizards models would soon be in demand, or at least very much more so. Snakes form no exception to these remarks, for the attitudes assumed by them in nature are not only various in the extreme, but in some cases downright peculiar. And, in good groups of reptiles peculiar characters and habits should be exhibited by showing them or exhibiting them by a duplication of the species composing the group. The blowing viper (*Heterodon*) should not only be preserved and shown with expanded and flattened fore parts, but at a state of rest likewise. Take another example in the little lizard *Anolis*, the American chameleon; we would by no means gain a full idea of its form and appearance from one specimen, colored bright pea-green, and the flaming red ornament at the throat retracted; but we should have a group of at least four or five of them, showing all such remarkable characters, as well as the various tints it may assume when it exerts it chameleonic powers. With many lizards and with many snakes this is not always necessary, and with them one good, faithfully colored cast will be quite sufficient.

Of course, the very large reptiles, as large Iguanas, Alligators, and even such large snakes as Anacondas and Pythons, admit of being skillfully mounted by the manufacture of bodies made of tow—that is, a manakin, with internal wire supports and a final clay covering; but, as I have said, it would appear that the time has come when all small reptiles will no longer be so preserved, and the tendency to cast them is on the increase. An ingenious method of preserving small reptiles in alcohol is resorted to by Mr. Samuel Garman at the Museum of Comparative Zoölogy at Harvard College, but I have never had the personal opportunity of investigating it, though the fact that so able an herpitologist recommends it as is Mr. Garman is enough to say that it possesses its merits for museum purposes. He claims that by its means he "can give the specimens life-like attitudes, or arrange them in groups, as if playing, courting, or fighting; and the liquid heightens their beauty, as the water does that of the pebble at the seashore, while ravages of insects are entirely out of the question."

The larger Chelonia, as the Hawksbill, the Green turtle, the Leatherback, and the Loggerhead, can also be mounted by the processes usually recommended by the best taxidermists and successfully, and Mr. Lucas has pointed out an admirable way for mounting the smaller turtles,* but even this does not convince me but what such mounts will finally be superseded by the plastic methods and subsequent artistic painting. I speak especially for the large scientific institutions where a full series of alcoholics can be maintained in alcohol, and the exhibition series are intended simply to faithfully present the external characters and appearances of the specimens.

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*Lucas, F. A.: On the mounting of turtles. Third Ann. Rep. Soc. Amer. Taxidermists, 1882–'83, pp. 84–90, 2 figs.

The National Museum possesses at least one very elegantly preserved crocodile. Mounted much in the manner pointed out above, it has been placed in an attitude of rest, with very simple surroundings, but made the more interesting from the fact that the taxidermist has placed upon its back one or two specimens of that small Black-headed Plover (*Charadrius melanocephalus*), which in nature may often be seen perched there, attracted as it is by the insects which occur in numbers upon that part of the huge reptile.

Here we not only get a fine and naturally preserved specimen of an important and widely known animal, but we likewise have represented in the most striking manner one of the most engaging chapters in its history.

In alluding to groups of reptiles, Hornaday, after all his long experience, has said that—

> I know of but one good group of reptiles, and that is a group of turtles which was prepared by Mr. F. A. Lucas, and displayed at the exhibition of the S. A. T. in New York in 1883, where it received a medal, and afterwards was presented by him to the National Museum. This altogether unique and pretty group teaches one very important lesson, viz, that even the most commonplace animals are interesting when they are well mounted and grouped with a setting which represents their natural haunts. Some of the specimens in this group are represented above water, and some beneath it, while one enterprising individual is caught in the act of diving, with half of his body under water and the other half out. The situation represents the successful accomplishment of a very neat mechanical feat and is of itself an illustration of the possibilities in such matters.*

But progress of the most substantial nature, thanks to Mr. Goode, is now being made along such lines in his collections of the U. S. National Museum, and I believe that in a very few years hence the exhibition series of this institution will stand among the very finest in the world. The consummate skill of the Palmers, Mr. Lucas, and a large trained staff of many others of the first ability in designing, painting, and casting, is sure to make it so. Dr. Stejneger has been kind enough to place at my disposition a number of the casts of his department (Reptiles), for which and other courtesies my thanks are here tendered him.

With regard to the attitudes assumed by snakes, we may say that they are exceedingly numerous and many of them very interesting to behold. To secure figures of these for the use of modelers and casters we have a host of fine illustrations throughout the literature of reptiles, but I am more and more inclined to believe that a work devoted to a carfully prepared series of photographs of snakes taken directly in

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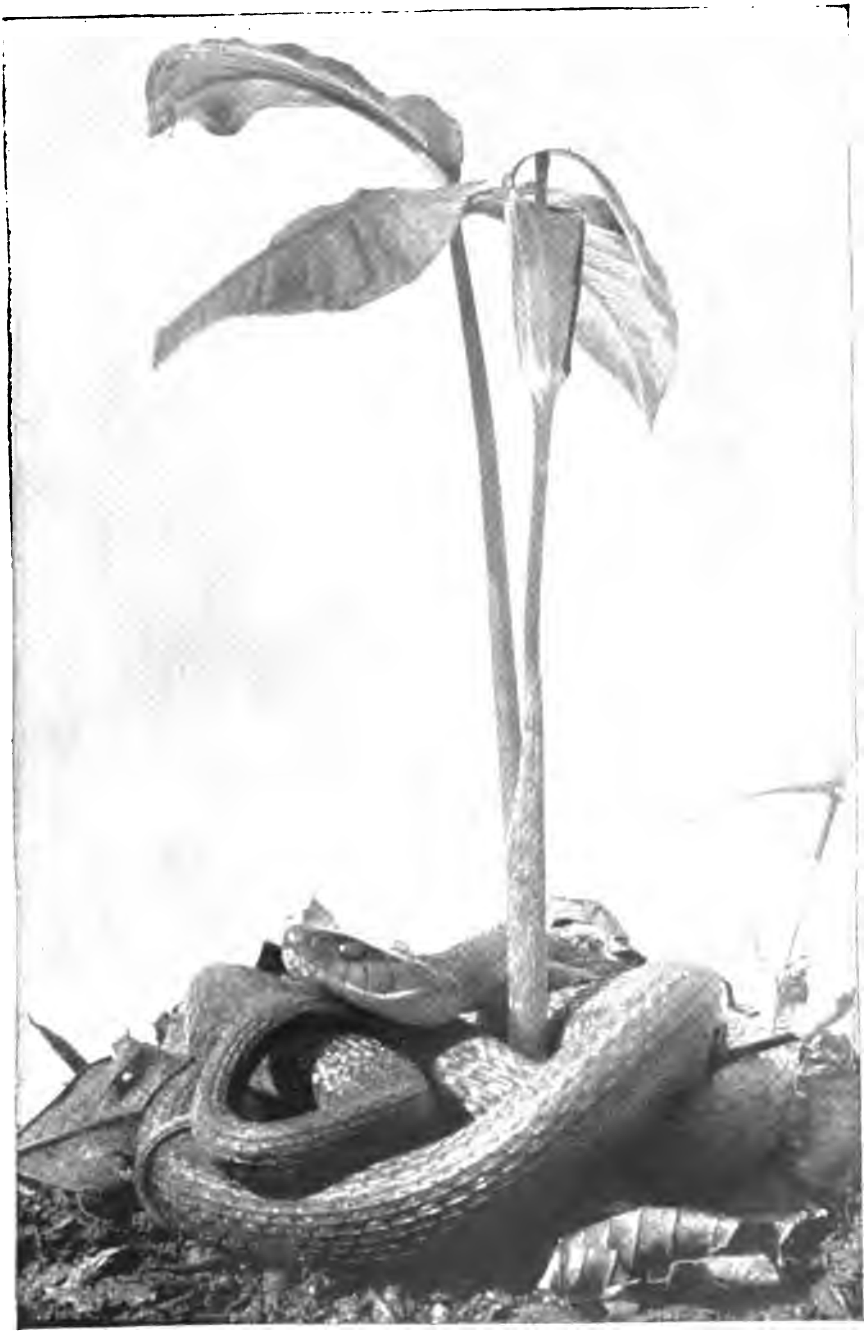
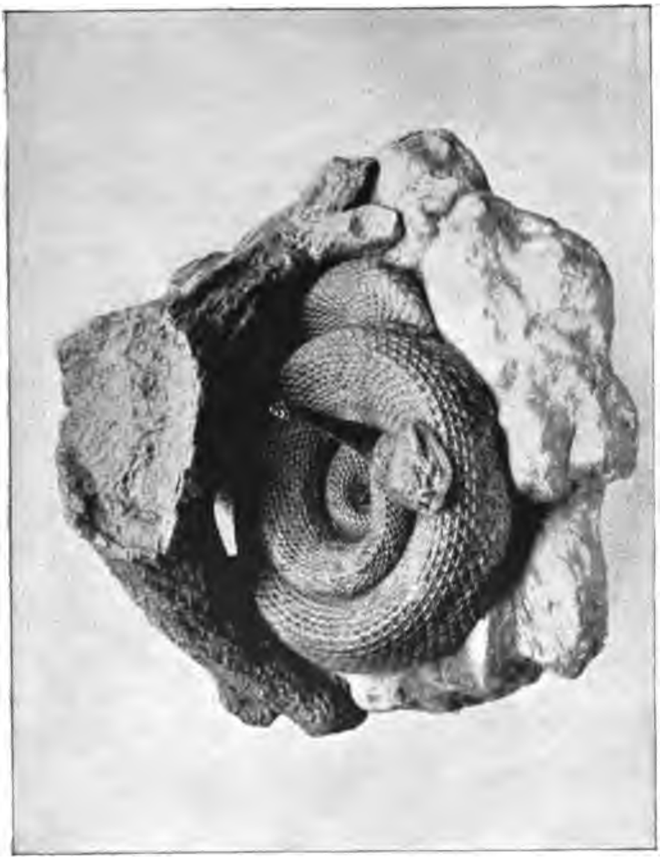
* Taxidermy, pp. 249, 250.



COMMON GARTER SNAKE (*Eutænia sirtalis*).
From a photograph of a living specimen by the author.



RATTLESNAKE (*Crotalus adamanteus*).

From a plaster cast; greatly reduced. (Cat. No. 8801, U. S. N. M.)

their natural haunts is in reality what is now most in demand. At zoölogical gardens, at least here at Washington, they are usually kept in wire cages, often huddled together, and rarely assume the animated attitudes most natural to them, and so, even if photographs could be obtained of them there, they would hardly meet the end in view. That they are easily obtained in nature I have recently demonstrated in one instance for illustration in the present connection, though I am confident with just a little more practice in that way the results can be made all that is to be desired. About a month ago on my premises I secured a good-sized Garter snake, uninjured in the least degree, and at once placed him in a large glass jar. Immediately I cut out, on the bank of a stream on my place, a suitable piece of ground, with plants growing on it, for my "base." This I placed out of doors on a large box about the height of my camera, and for a background behind it I placed a large sheet of common white blotting paper. My snake was then removed from his jar and placed on the base. By tapping him on the head he at once threw himself in the position I secured him in in the photograph, of which Plate XXVII is a good copy.

Now, this operation altogether took less than an hour, and a fairly good figure was the result. But it may be accomplished very easily in another way; for all we have to do is to "go afield" armed with our camera and a necessary number of plates, and a thin board covered with white blotting paper for our background, to be used for cutting off superfluous foliage, etc. On meeting with a snake, or indeed any small animal, he may in 50 per cent of the cases be obtained by the methods above indicated. Recently I have even succeeded in getting them on the ground by placing the camera right down in front of them, putting up my background, then assuming a prone position myself, focused and got my figure.

Such a photograph of the Helodermas was obtained by me in New Mexico. The specimens represented in it were my own; they were healthy and vigorous, and had been disporting themselves in the sun, when, becoming tired, they sought the shade of some plants, and as they assumed positions of rest I there photographed them.

All the figures of snakes given in the present report are from plaster-of-Paris casts in the collections of the National Museum. They were all made, I believe, by Mr. Joseph Palmer, and most naturally colored. They are wonderfully fine things, and a credit to any museum in existence. But what is still more to the point they faithfully represent the originals, and that is what we want. Not only are these snakes in plaster, but so are the tasteful bases of rock, etc., upon which they have been placed. Take, for example, the rattlesnake shown in cast 950. With tail elevated, and the reptile thrown into natural coils, partly within the recess of the spreading roots of a large tree, we have an accomplishment in plaster the equal of which for that particular snake I do not believe to be extant.

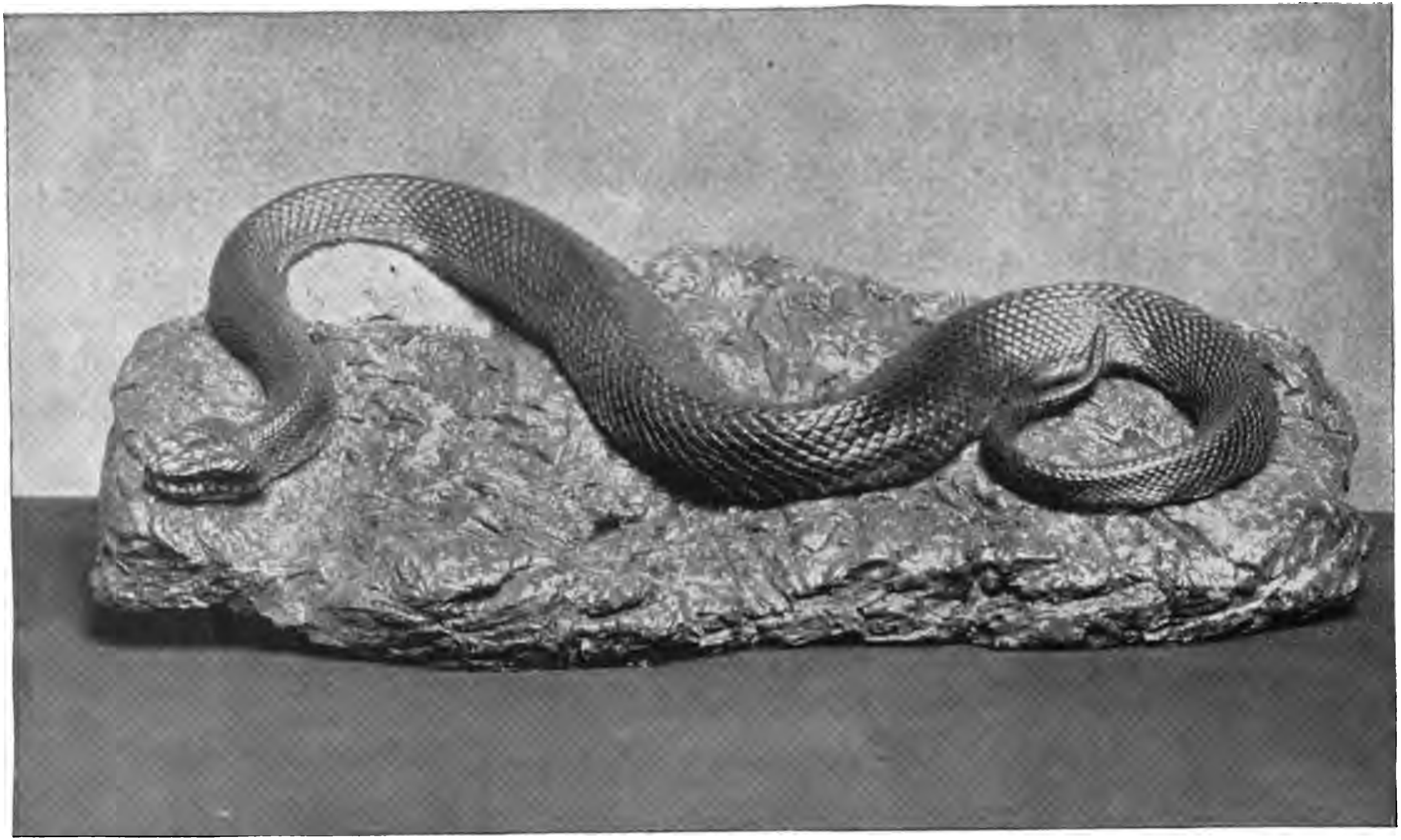
Quite as good is the young *Ancistrodon* in the collection, for here, too, the snake is partly within a recess and fully the anterior fourth of the animal free.

Errors can sometimes occur, however, even in apparently such a simple procedure as properly coiling up a snake for a plaster cast, and as fine a work of art as it is in other respects, I am inclined to think that in nature a snake never so abruptly bends the neck as close to the head as has been done for the one in Plate XXX. A dead snake may be placed in a great many postures which in nature it never assumes, and these dead attitudes must be guarded against; and it is just here where the results of good photographs of snakes in nature come in most advantageously.

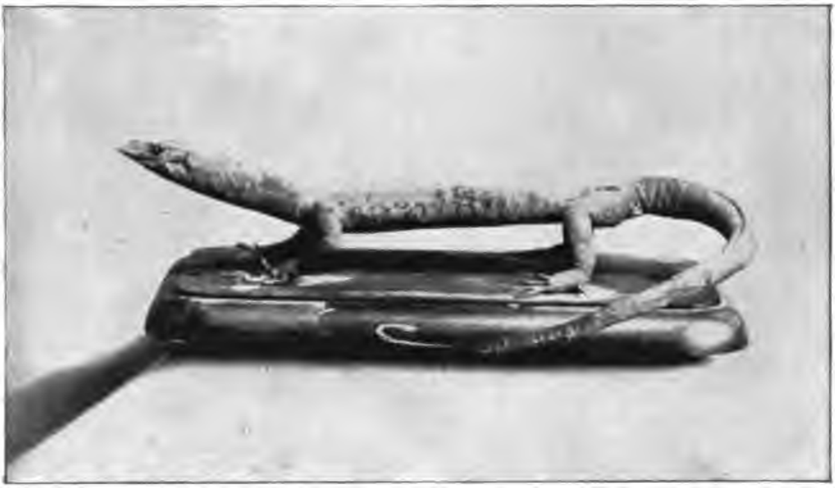
In the coloring of snakes and other reptiles we should rely solely upon specimens that are alive, and taken as subjects if possible just after the "shed." It is almost needless to add that a cast should only be painted from the snake from which the cast was made, and not another specimen of the same species. Frogs, for some reason or other, are not always well drawn and colored, and, as I have before remarked, some of the most abominable stuffed specimens and casts of them are in existence. Those in some of our museums bear no closer resemblance to the original animal than a camel does to a chestnut burr. They are simply horrid. This is often the case, too, in many departments of decorative art. Even our Indians, who occasionally make pretty good hits, crude as they are, at pictorial decoration with some of the animals they happen to be most familiar with, miss it when they try the frog. Attempts made by the Japanese in such matters are often very much better than the results turned out by the brushes and implements of our own artists and designers. There is one very life-like plaster-of-Paris cast, colored, of this Batrachian in the collections of the National Museum, and it is reproduced in Plate XXXI of the present paper. It shows the animal in one of its most common poses, and may well serve as a model for anyone who desires to copy it for any purpose whatsoever.

Some grand results in the matter of the casting of turtles, both large and small ones, have been accomplished in the workshops of the Museum. These are either in plaster-of-Paris like all the specimens here figured, or in some few cases the natural shell of the animal has been retained, and the exposed external parts, as head, legs, and tail, cast in the usual plastic material used, and subsequently fitted to the former. When cast in plaster-of-Paris, they of course have to be painted, as in the case of all animals so reproduced. When photographed, these tints do not show, and consequently my figures, with the partial exception of the box tortoise (*Cistudo*), exhibit only the form of the specimen.

Especial attention is invited to the beautiful cast of *Aspidonectes* Plate XXXII, which is not more than one-sixth the linear length of the

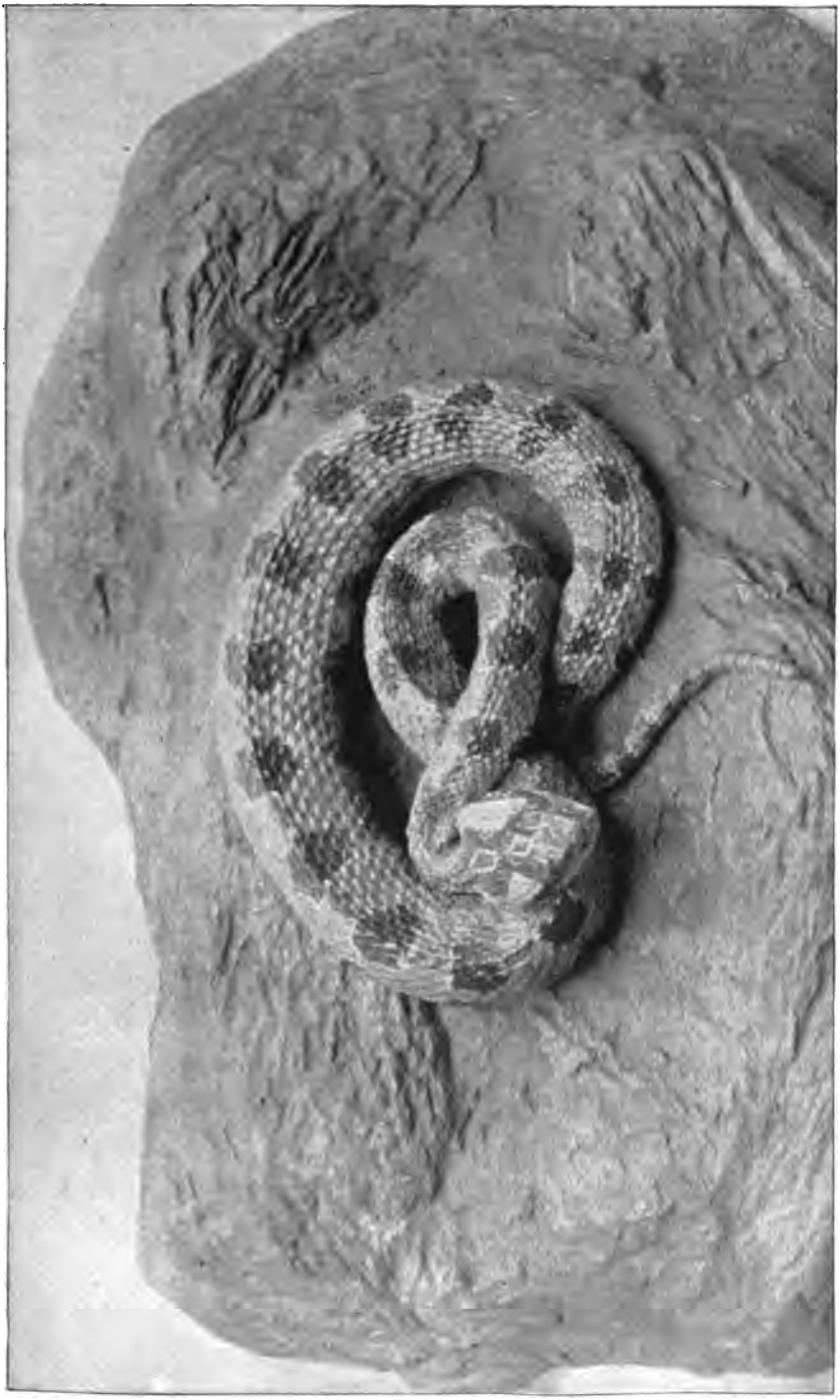


ANCISTRODON PISCIVORUS.
Plaster cast; greatly reduced. (Cat. No. 10488, U. S. N. M.)



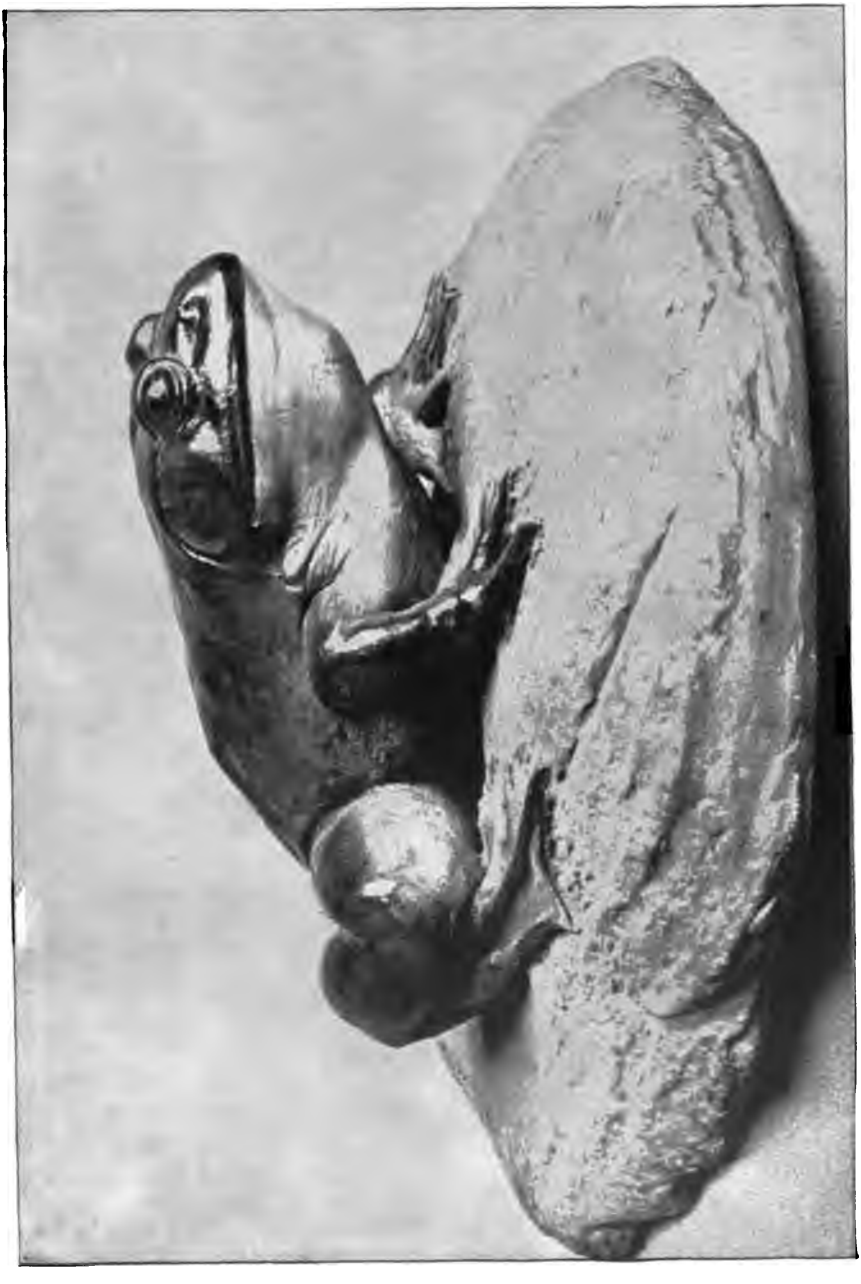
MONITOR GOULDI.

Stuffed specimen; old style, faulty mounting. (Cat. No. 8896, U. S. N. M.)



SISTRURUS MILIARIUS.

From a plaster cast; greatly reduced. (Cat. No. 9966, U. S. N. M.)



BULL FROG.
From a plaster cast; reduced.

original. So far as external form is concerned it simply stands as good as the original, as offering to the naturalists of all ages an absolutely correct idea of this interesting chelonian. Lizards are more difficult to cast than are turtles, as in many of their details of external structure they are more delicately formed, and, upon the whole, I do not think an equal success has been attained at the Museum in the plaster casting of saurians as has in the case of the chelonians. Nevertheless the plaster casts of some of the larger lizards leave us nothing to be desired in that art. A truly magnificent thing is seen in the plaster cast of *Tupinambis* (Plate XXXV). It would seem to be perfect in every particular, and by all odds is the finest result of the kind that I have ever had the pleasure of examining.

Just here this is all I have to say in regard to the preservation of reptiles for museum exhibition, but the subject, in a general way, will be reverted to again before closing this paper.

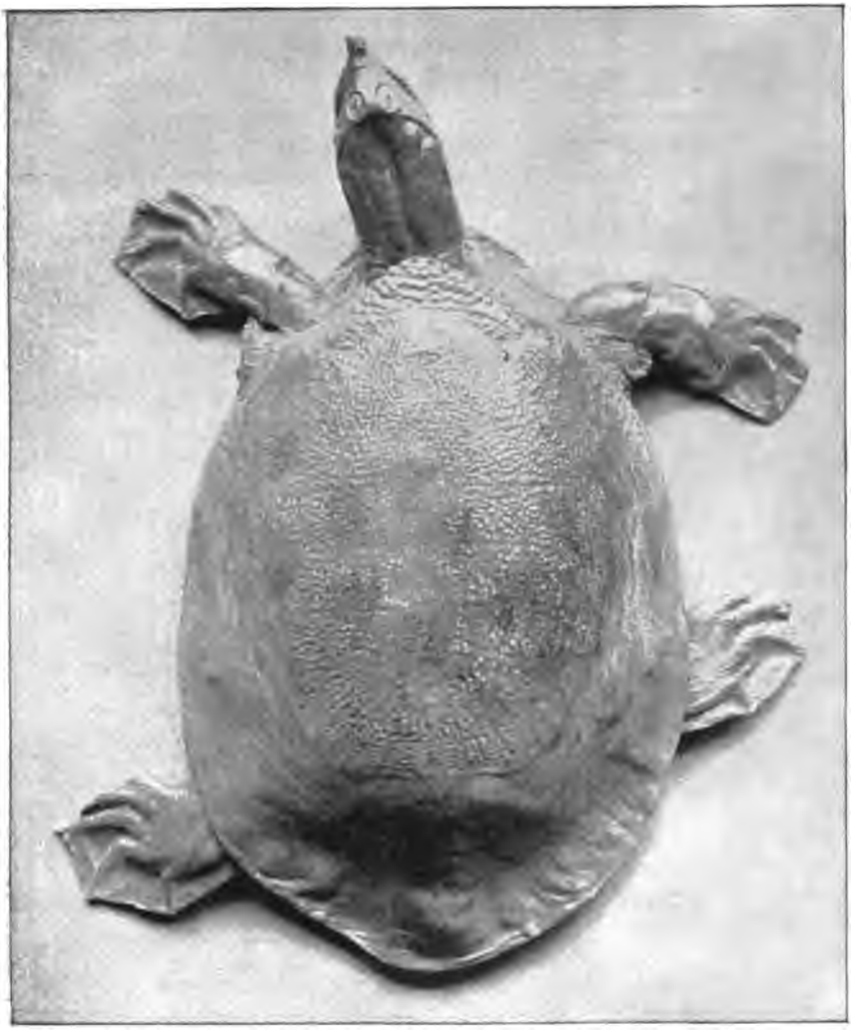
We next pass to a consideration of the preservation of birds. Upon entering this department, after passing fish and reptiles in review, we seem almost to come into entirely new fields. Zoölogically birds are not one bit more important than either fishes or reptiles, but from a popular standpoint they have probably received, as every biologist knows, fully fifty times the attention. Ornithological literature, taken by and large, is a hundred fold more voluminous than that of the two other groups just mentioned put together. Thousands of birds have been preserved by one method or another (not including alcoholics), to *one* fish. When one alludes to the art of taxidermy in the presence of the laity the idea that first comes up is, that the taxidermy of birds only is intended; mammals are far less frequently thought of by such people; and fish and reptiles rarely or never. Plates, figures, drawings, and illustrations of this group are far more numerous; and, notwithstanding my sincere efforts to equalize the illustrations for the various departments in this paper, somehow or other the plates of birds constitute nearly one-half of them. Many taxidermists devote themselves to birds alone, and it is only those in this country who are really finished adepts in the art that can skillfully handle the preservation of any kind of an animal whatever, birds included.

Taking all this into consideration, one would naturally think that that department of taxidermy had made far greater progress than any other; but I hasten to say this is by no means the case. If we take the collections of such an institution as the National Museum for example, we find upon examination that there is quite as much bad taxidermy among birds as there is among mammals, and when it is bad it is very bad. On the other hand, from the host of "terrifics" that still linger in the cases of the ornithological department there has been growing out of it of recent years a most satisfactory and most encouraging progress. Both individual specimens as well as groups of birds are now being produced which bear every evidence of the highest accomplishments attained to by taxidermists anywhere in the world. There are two great reasons for this: First, taxidermy itself has only recently been raised from the plane of mere cheap jobbery to the place it long ago should have occupied—that is, to a school of living art; and, second, the selection from that school for employment in the Museum of at least a representation.

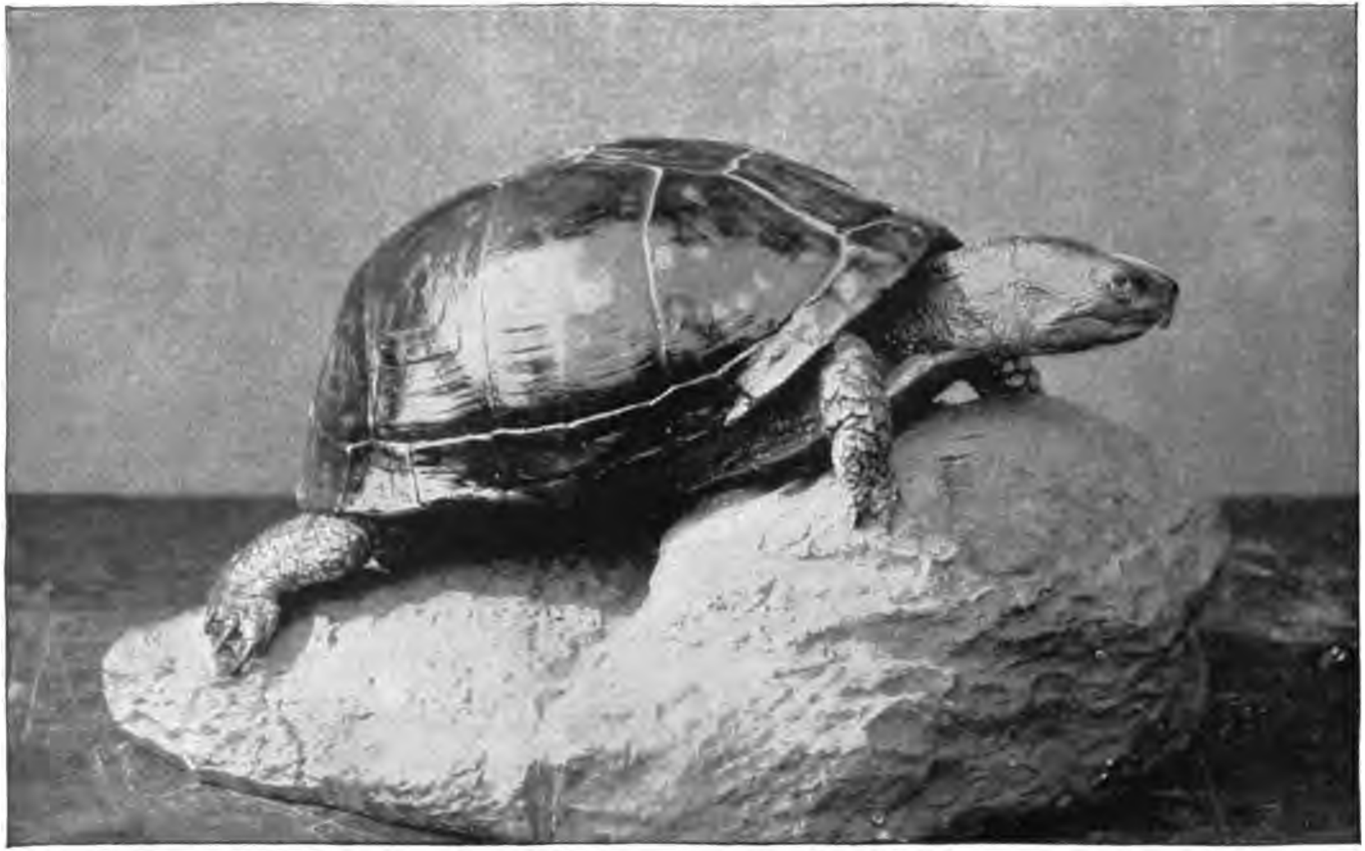
Everything I have thus far said in the foregoing pages in the matter of models, of grouping, and, indeed, of reproducing nature in the Museum with respect to fishes and reptiles, applies with equal force to birds. With regard to the photography of birds in their native haunts and elsewhere, for the purpose of securing models as guides to natural attitudes of this class of vertebrates for the taxidermic artist, it would seem to be far more important here than with either reptiles or fish. This is so from the fact that in the case with the last two the specimens are now most frequently cast, while, as we well know, with birds it is different; they being skinned, the artist must have a model to go by for the restoration of form.

Where models are not followed, especially in those cases where the taxidermist may never have seen the bird either alive or even a good figure of it, the most pitiable results follow. This is well seen in Pl. XXXVI, showing two king penguins—birds of the same species. The taller of the two was mounted by one of the old school-men taxidermists years ago, and it is so bad that I consider it quite beyond the pale of criticism. The second and more upright bird, recently done at the Museum, although in some particulars not everything it should be, is such an advance upon the first, that comparison becomes quite unnecessary. Bad mounting of the kind just referred to is still more disastrous when it has been done in the case of a bird of great rarity, and consequently of almost priceless value. This was unfortunately the case in regard to the specimen of the Great Auk (*Plautus impennis*) owned by the National Museum. A figure of this as first mounted by some ancient bungler is shown on Pl. XXXVII, Fig. 1. No living auk in good health ever stood in that position; but thanks to what art can sometimes accomplish in these days, this outraged bird was not destined for all eternity to stand as a drum-major at dress parade.

It was determined to have it remounted; an operation, owing to the age of the specimen and a lack of knowledge as to what condition the skin might be in, that required a full measure of judgment relative to what taxidermy could hope for in such premises. The work of remodeling was accomplished by Mr. Wood, of the National Museum, and the result is shown in Plate XXXVII, Fig. 2, and this now probably extinct fowl, one of the treasures of the department, presents a far more respectable appearance, and is certainly posed in a far more natural attitude, though judging from Audubon's plate of it, I believe it still to be not a posture this auk was wont to assume. Still, it was most assuredly the



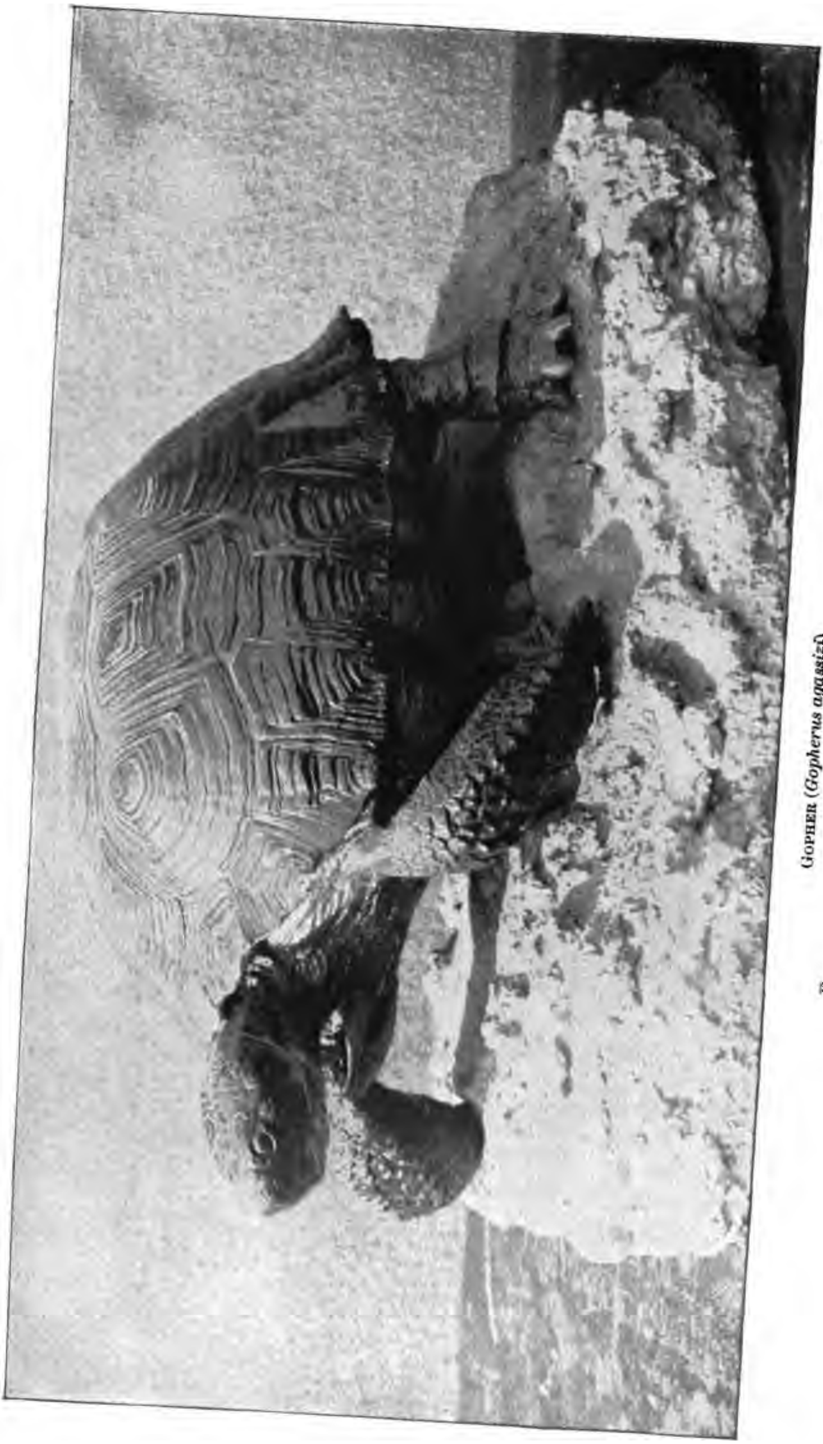
SOFT-SHELLED TURTLE (*Aspidonectes ferox*, ad.).
From a plaster cast; greatly reduced. (Cat. No. 8899, U. S. N. M.)



BOX TORTOISE (*Cistudo clausa*).

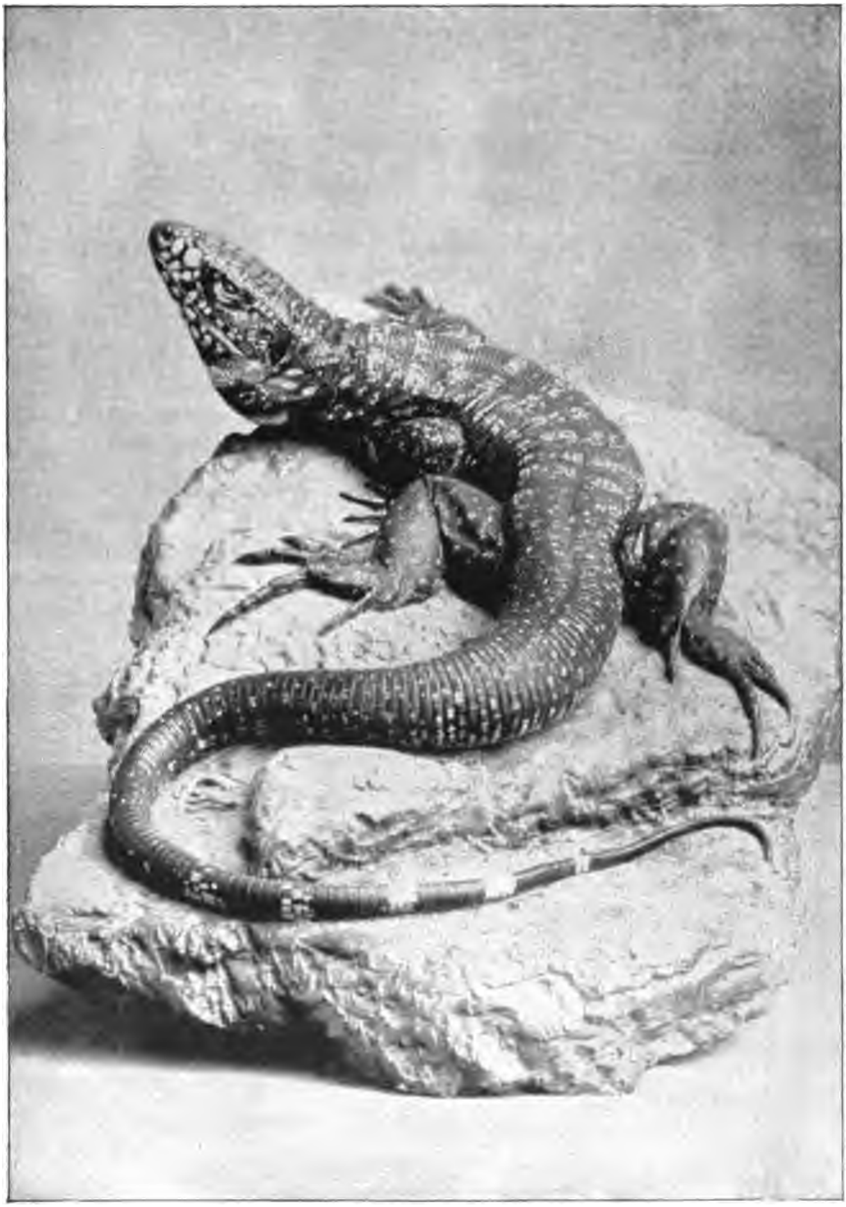
From a plaster cast; reduced. (Cat. No. 10329, U. S. N. M.)

PLATE XXXIV.



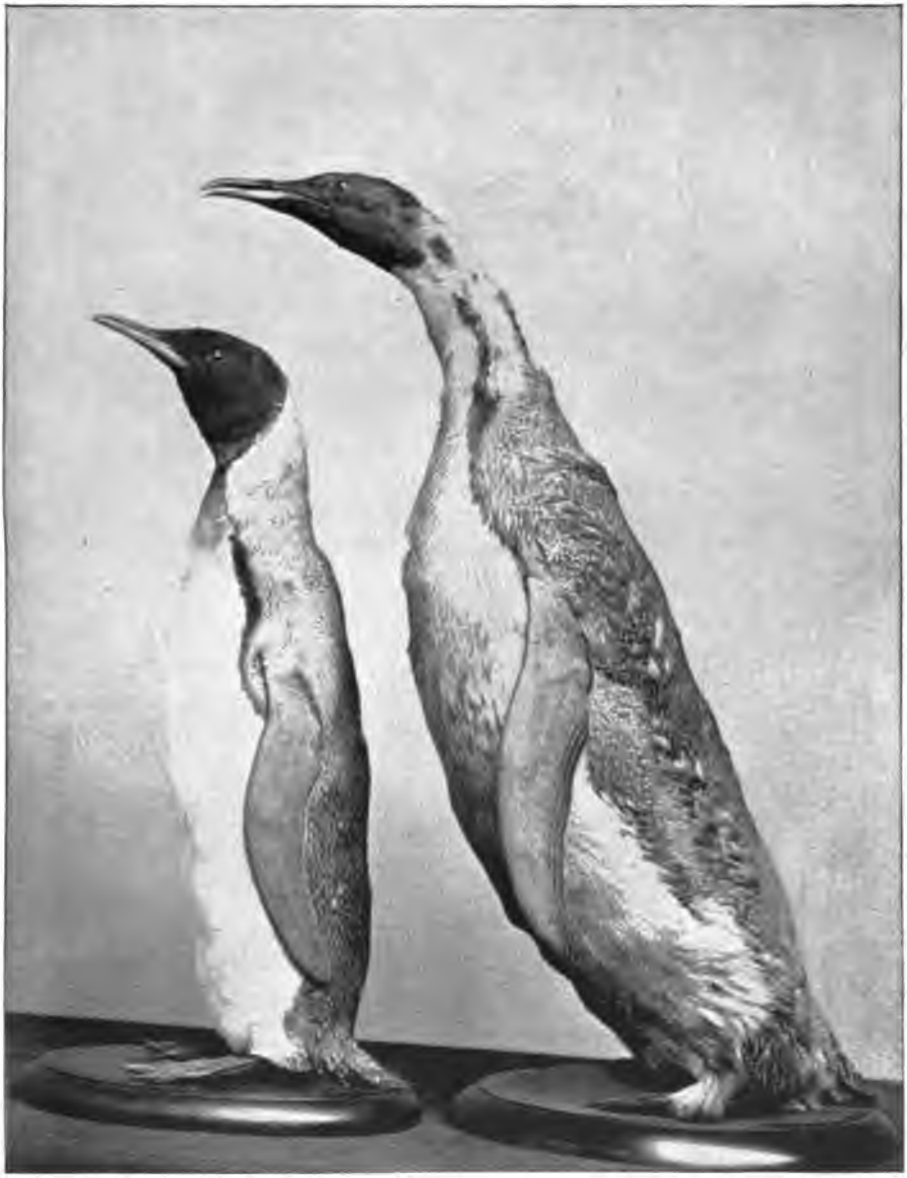
GOPHER (*Gopherus agassizi*).

From a plaster cast; reduced. (Cat. No. 10412, U. S. N. M.)



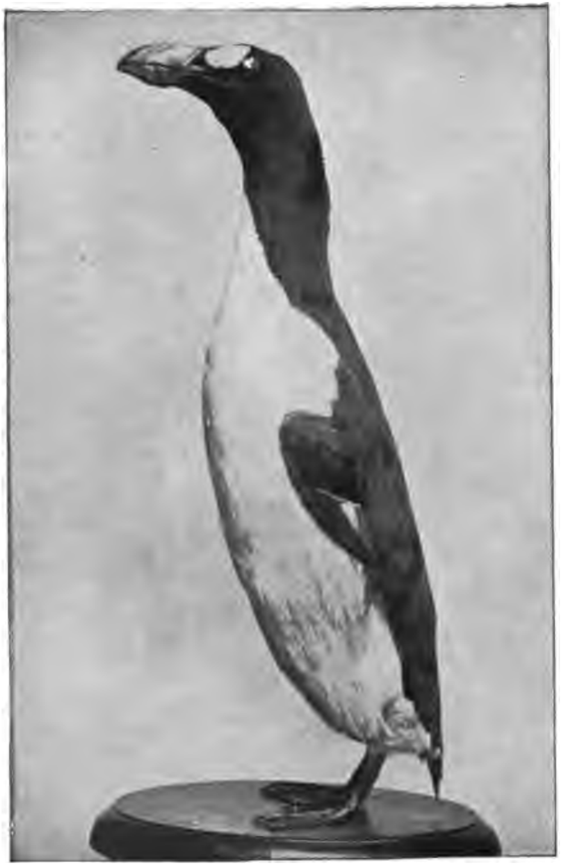
TUPINAMBIS TEGUIXIN.

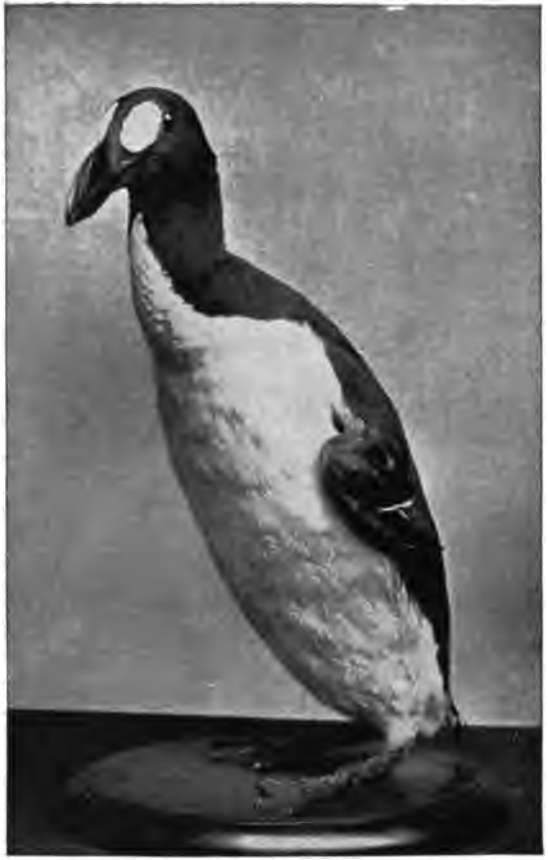
From a plaster cast; reduced. (Cat. No. 20790, U. S. N. M.)



OLD AND IMPROVED METHODS OF MOUNTING A PENGUIN.

From specimens in the National Museum. (Cat. Nos. 124684 and 15686, U. S. N. M.)





THE GREAT AUK (*Plautus impennis*).

(Cat. No. 57338, U. S. N. M.)

Fig. 1. As first preserved.

Fig. 2. As remodeled by Mr. Nelson R. Wood.

very best that could have been done under the circumstances; for when birds' necks are stretched out of all proportion, and then allowed to remain that way for years, it is by no means an easy matter to even partially restore them again to their normal lengths. Even among the more common birds there still linger numerous examples of old-style bird stuffing in the cases of the National Museum. Some of these absolutely violate every correct principle of taxidermy, and it is devoutly to be hoped that the time is not far distant when they can be presented to some fourth-rate museum or college "in the provinces." Surely both this Museum and the people have outgrown such scarecrows. I allude to such looking affairs as we have represented in Plate XXXVIII of this report, a specimen of *Larus occidentalis*. Now, gulls make especially beautiful subjects when they are well mounted; for in nature they are graceful in the extreme, and their plumages, so simple and so harmoniously blended, are very attractive. Plate XXXIX, a mounted specimen of *Creagrus furcatus* in the national collection, is in my opinion an absolutely lifelike reproduction of the bird as it appeared when it was alive. It is nature and simplicity itself, and, with its neat stand, leaves nothing to be desired in the way of mounting a single individual in an attitude of rest.*

There is no class of vertebrates that admit of grouping for museum exhibition that can exceed birds. Most of the species are small, which is an advantage, inasmuch it allows us to increase the amount of natural surroundings; then a great many birds have very peculiar habits and construct a great variety of nests, and these may often be reproduced with the greatest possible interest.†

One of the most lifelike groups of birds known to me is the pair of Black Ducks (*Anas obscura*) and young, which form a part of the ornithological mounted collection of the American Museum of Natural History of New York City. Through the kindness of Dr. J. A. Allen, of that institution, I am enabled to present that group here as one of my illustrations. It is shown in Plate XL.*

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*This gull was the work of Mr. Nelson R. Wood, one of the taxidermists employed in the National Museum, who also prepared all the mounted domestic fowls and pigeons here shown with the exception of the white-faced black Spanish cock (Plate LXIX, Fig. 2); the Parrot (Plate XLIV, Figs. 1, 2); the Baltimore oriole (Plate LXXIII); the turkey (Plate XLVIII,); and the great horned owl (Plate LXXII). Mr. Wood has cheerfully tendered his assistance to me in several ways during my examination of specimens, for which he fully deserves my thanks, as he does for the loan of his living specimen of Gambel's partridge and Black Sumatra cock, both of which by photography have been secured for plates for this paper.

†According to Mr. Goode: "The mounting of animals in picturesque and lifelike groups in the midst of accessories taken from their natural haunts appears to have been first attempted by Prof. Paolo Savi in the early part of the present century. In the museum of the University of Pisa nearly one hundred of these are still preserved. One of these, a group of starlings upon the head of a dead sheep, is as fine as anything since produced anywhere; and a pair of boar hounds attacking a boar is, for action, the best piece of mammal mounting I have ever seen. The collection is a wonderful one, and is still perfectly preserved."

The subjects shown in Plate XLIII, Parrot; Plate LXI, California Partridge; Plate LXII, Massena Partridge; Plate LXIII, Quail; Plate LIX, Fig. 2, Quail; Plate LXIV, English Pheasant; Plate LXV, Moor Cock; Plate LXVII, Ruffled Grouse; Plate LXVII, Fig. 1, Dusky Grouse; Plate LXVII, Fig. 2, Richardson's Grouse, and the well-mounted turkey head in Plate LXIX, are all examples of Mr. Denslow's style of mounting. My thanks are due him for the loan of the drawing from which the figure of the Great Horned Owl, shown in Plate LXXII, was made. It is from his well-filled "note-book" of drawings and photographs of all kinds of animals from life and good illustrations—just such a book as every taxidermist should compile. Mr. Denslow was at one time employed by the National Museum and is in my opinion a taxidermist of the highest order of merit.

Great simplicity may characterize groups of birds, or they may be gotten up with every refinement of detail. A beautiful piece of work representing the former style is to be found in the collection, where two flamingoes and their nests are represented; while of the latter kind, it would be difficult to find a group anywhere that would present so many interesting features, and such wonderful harmony in detail, as is seen in the group of jacanas, which, together with the flamingoes, were sent on to the World's Columbian Exposition. The piece of pond work in this latter, including the flowers and their leaves, and the handling of the bottom, are simply exquisite. Such work is an adornment to any museum, and a whole chapter in zoölogical science to any visitor who may chance to give it any study whatever. The artist, I regret to say, is not known to me, but there is no question that he knew a jacana.† I have seen the birds alive in nature, and the way he has rendered the peculiar habit the males have of vertically erecting their wings, in a manner similar to our Solitary sandpiper, is capital. This delicate case, as I have just said, was sent on to the World's Fair at Chicago, and it is to be hoped that no misfortune will befall it either in going there or having it returned here.

Perhaps some of the finest groups in the world are at South Kensington of the British Museum, and at the commencement of this paper I quite extensively quoted from Dr. Sharpe's article upon the nature of many of them. That distinguished ornithologist, who is in charge of the department of ornithology there, has kindly sent me, as I have before said, two beautiful photographs of their method of mounting specimens of the diurnal Raptores. Those photographs, unfortunately, I had to have very much reduced, but still they show very well the

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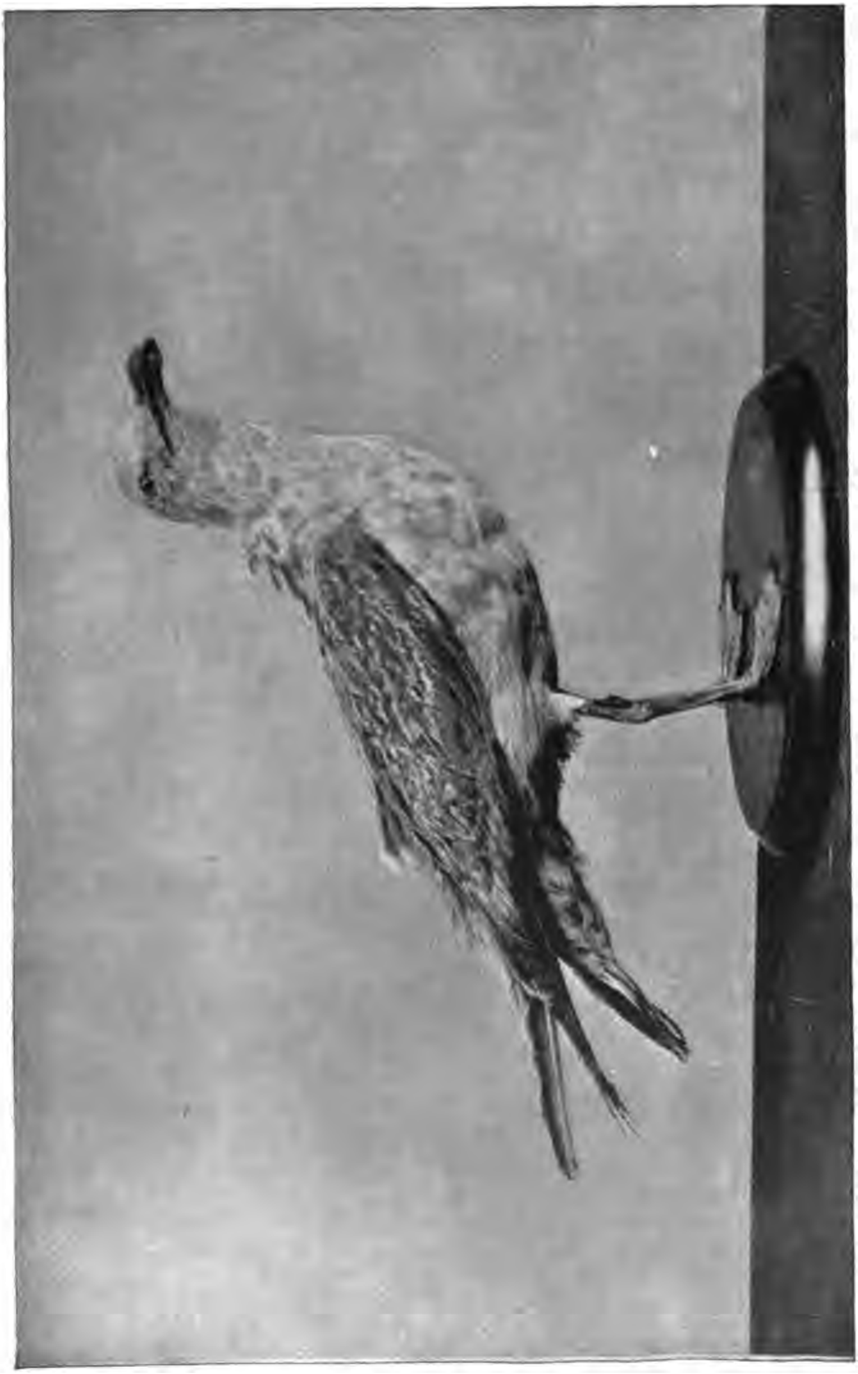
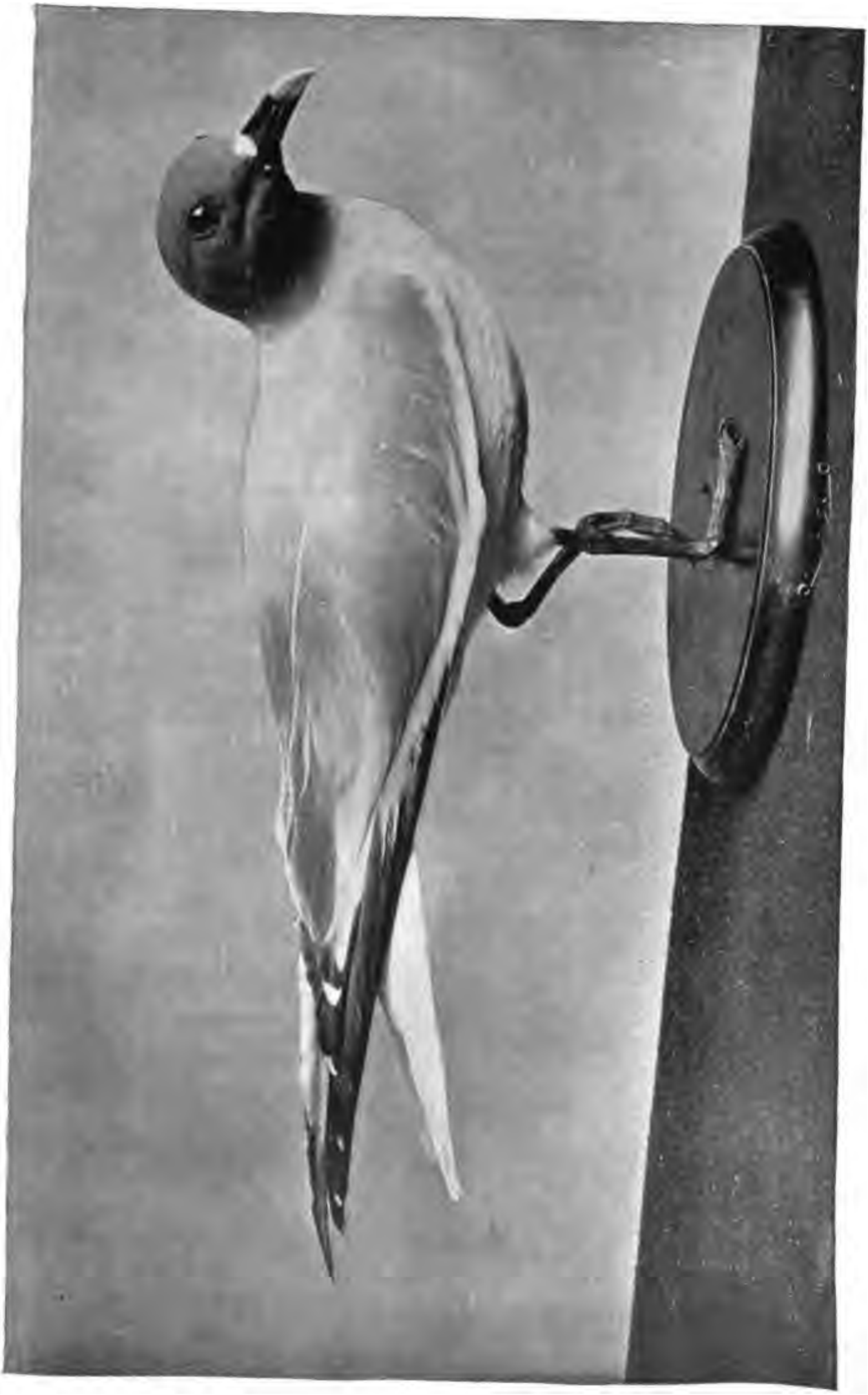
*This group was designed and prepared by Mr. Jenness Richardson, at the American Museum of Natural History, in 1890; the studies being made from life at Gardiner's Island, New York, in May, 1889. The accessories were made by Mrs. E. S. Mogridge, under the supervision of Mr. Richardson, and are actual facsimiles from nature.

†The group was mounted by Henry Marshall, for many years the principal bird taxidermist in the National Museum.—EDITOR.

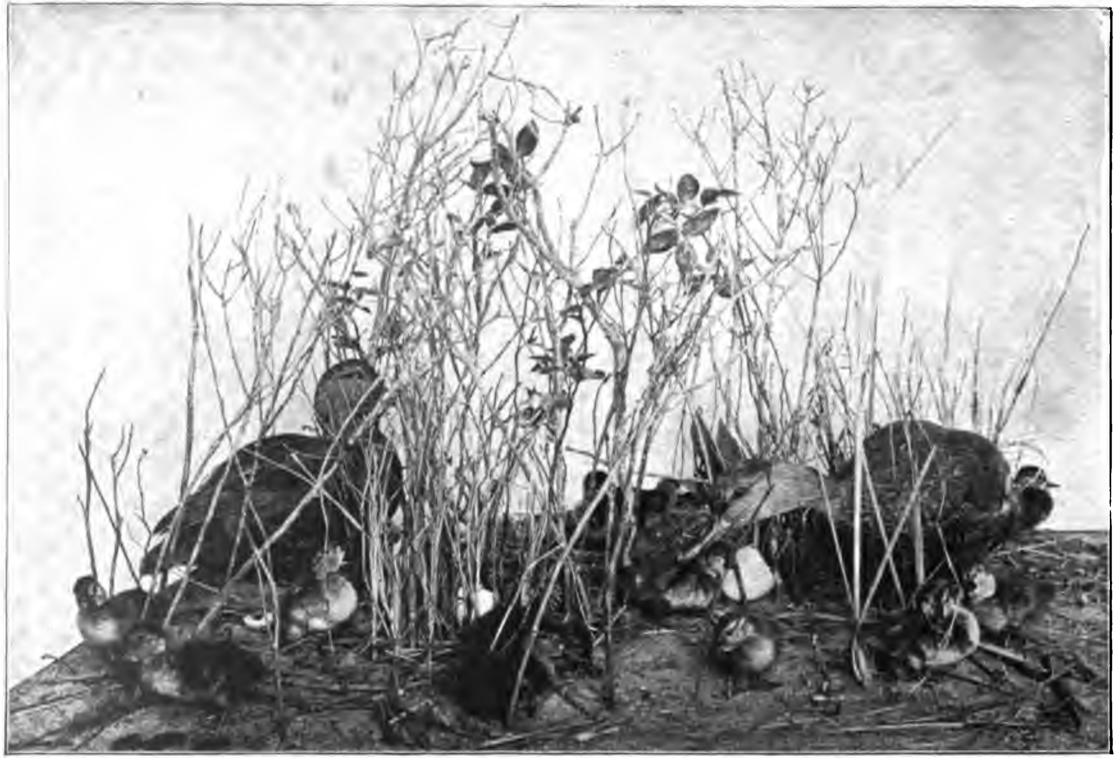


RING-BILLED GULL (*Larus occidentalis*, juv.).
Example of an incorrectly mounted Gull. (Cat. No. 6474, U. S. N. M.)

PLATE XXXIX.



SWALLOW-TAILED GULL (*Creagrus furcatus*).
Example of correctly mounted Gull. (Cat. No. 115968, U. S. N. M.)



BLACK DUCKS AND YOUNG (*Anas obscura*).

From a figure published in "The Auk," of a group in the collection of the American Museum of Natural History, New York. Reproduced by permission of Dr. J. A. Allen, editor of "The Auk."

grandeur of the scale upon which such work is executed. Their copies are faithfully rendered in Plates XLI and XLII, and to study them simply means to excite our fullest admiration for such bold and truthful rendering. In Plate XLI one of the birds is exhibited in full flight, and yet the rocky wall behind him seems to be in contact with his tail, and, inasmuch as there is no perch for him to have pitched off of in full flight, the question might naturally arise, going at the rate he apparently is, whence did he come? The defect so apparent is probably due to the picture itself, which does not represent the actual and necessary space that exists between the sailing bird and the rocky cliff behind him.

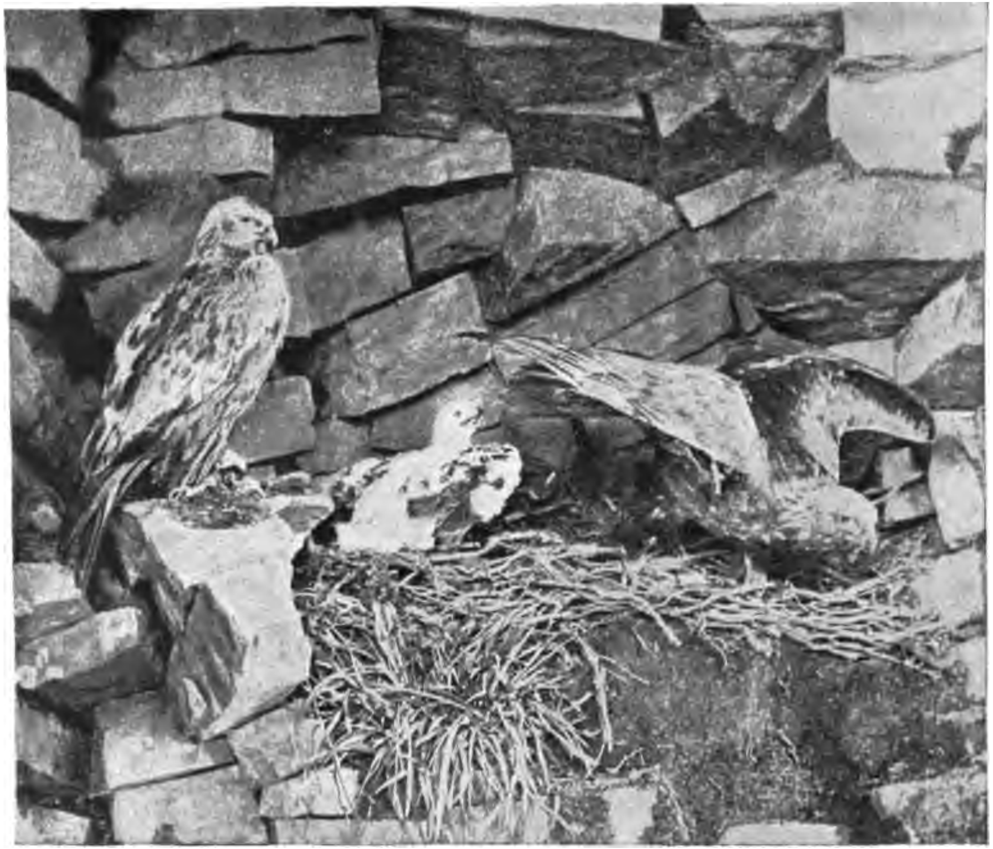
Such illustrations bring up to my mind the great question of the amount of activity permissible in birds mounted for museum exhibition. My opinion in these premises can be briefly put. The great bulk of individual specimens of small birds exhibited in the cases of a large scientific zoölogical museum should be mounted up on the T of the perch in one of the most common attitudes of the species; a slight dipping forwards, or slight inclination of the head in some direction, being alone permissible. But this would give rise to great monotony, and to break that we would advise a certain amount of activity in single specimens. This should be accorded to those birds which normally are very active in nature. With respect to groups of birds we may to a greater extent indulge in arranging birds in different attitudes. At the best this is what we would naturally look for anyway, for in groups of birds the individuals composing it are more frequently mounted in the act of performing something, either feeding their young or flying, or nest-building, or some other avocation. Even violent action, as fighting each other, or capturing their prey, may be introduced in a limited number of groups.

The scolding parrot, shown in Plate XLIII, which, by the way, is a masterly piece of work, is an excellent example of activity shown in a single specimen, and this one subject would give relief to a dozen quiet parrots in the same case; or, for example, the other species, equally as well rendered, shown in two views in Plate XLIV, Figs. 1 and 2. For ordinary small birds the style shown for the female oriole in Plate LXXIII is sometimes desirable, especially when a bird is selected having such active habits as the oriole has, and where the artist can succeed in reproducing one of its more usual postures as well as has been done in the case of this specimen. Otherwise it most certainly should not be attempted. But the acme of all activity and of all grouping is reached when such artistic pieces of work, so faithfully executed, so full of interest and all that is natural, are set forth as the piece shown in Plate XLV. Mr. Adams, who both collected and mounted this most attractive thing, would certainly have "capped the climax" had he been able to have brought home the very section of the tree in which that identical Hornbill built her nest. This part is artificial, having been built up of fine papier-maché; but it is only fairly well done. It represents the male of one of the species of Hornbills feeding the female, whom he has imprisoned during the period of incubation in a hollow tree. I never pass it that I do not think of what Wallace has said of the habit in his Malay Archipelago (p. 147):

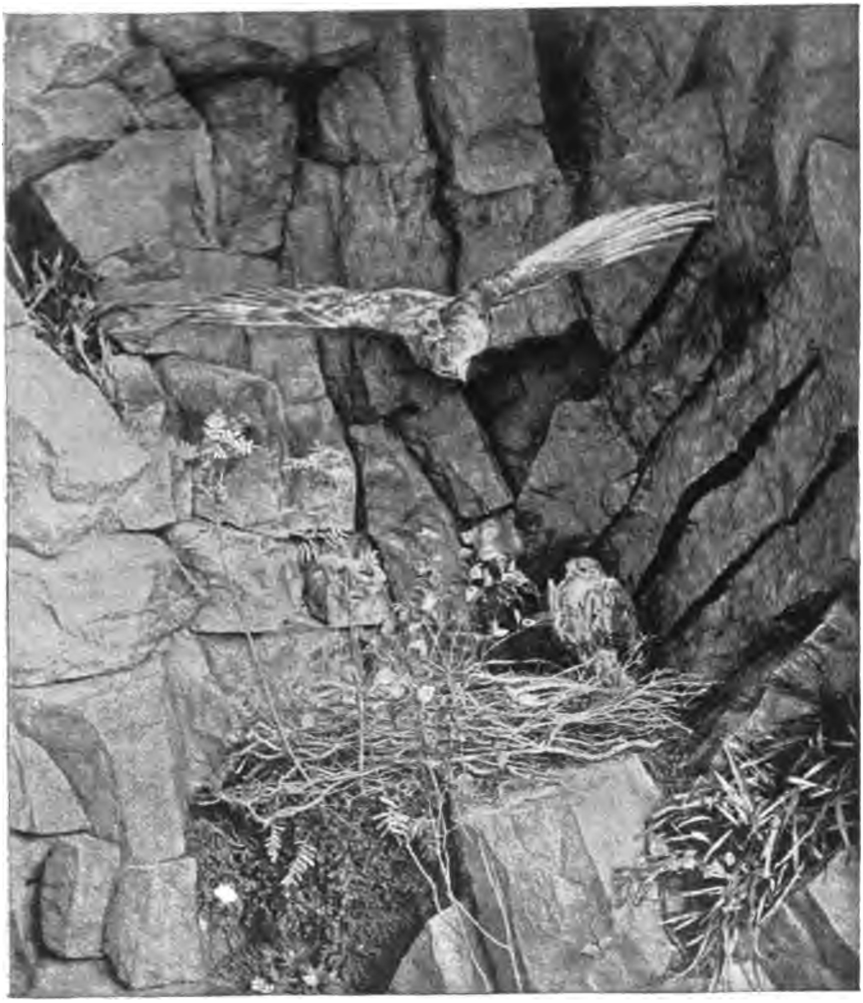
> I had sent my hunters to shoot and while I was at breakfast they returned, bringing me a fine large male of the *Buceros bicornis*, which one of them assured me he had shot while feeding the female, which was shut up in a hole in a tree. I had often read of this curious habit, and immediately returned to the place, accompanied by several of the natives. After crossing a stream and a bog, we found a large tree leaning over some water, and on its lower side, at a height of about 20 feet, appeared a small hole, and what looked like a quantity of mud, which I was assured had been used in stopping up the large hole. After a while we heard the harsh cry of a bird inside, and could see the white extremity of its beak put out. I offered a rupee to anyone who would go up and get out the bird, with the egg or young one, but they all declared it was too difficult and they were afraid to try. I therefore very reluctantly came away. In about an hour afterward, much to my surprise, a tremendous loud, hoarse screaming was heard, and the bird was brought me, together with a young one which had been found in the hole. This was a most curious object, as large as a pigeon, but without a particle of plumage on any part of it. It was exceedingly plump and soft, and with a semitransparent skin, so that it looked more like a bag of jelly with head and feet stuck on than like a real bird.
>
> The extraordinary habit of the male in plastering up the female with her egg and feeding her during the whole time of incubation and till the young one is fledged, is common to several of the large hornbills, and is one of those strange facts in natural history which are "stranger than fiction."

A very favorable commencement has been made at the National Museum of illustrating our own native birds by similar methods, and it would not be easy to overestimate the value and interest that attach to so important a step. We have already in one handsome single case a pair of shrikes with their nest and young in a thorn-apple bush, while upon several of the spines of the latter are suspended various insects and a small mammal, showing the habit of those interesting birds in nature of thus impaling such creatures. Others are in the course of making, and still others in contemplation. A pair of Wood Ducks with their real nest, taken from some lofty tree, is a good subject for some enterprising artist, and many others suggest themselves to us. There were magnificent groups of our birds sent on to the Columbian Exposition at Chicago, and when these are returned, as they will be, it will form a fine basis for such a collection to be added to in the future. I fear I must leave a great deal unsaid here that I would like to say, but it is to be devoutly hoped that the wide interest our people are taking in such matters, and the national desire of building up a National Museum at our fair capital, will induce our Government to open the public purse to the extent of bestowing the room required for the proper exhibition of this series, even to the giving of a large and suitable building, now so much needed through the rapid increase and accumulation of such treasures.

This will be the more necessary inasmuch as within a few years past, through the wise foresight of Mr. Goode, another very important de-



METHOD OF MOUNTING DIURNAL RAPTORES EMPLOYED IN THE BRITISH MUSEUM.
Reproduced from a photograph lent by Dr. R. Bowdles Sharpe, keeper of the Department of Ornithology, British Museum.



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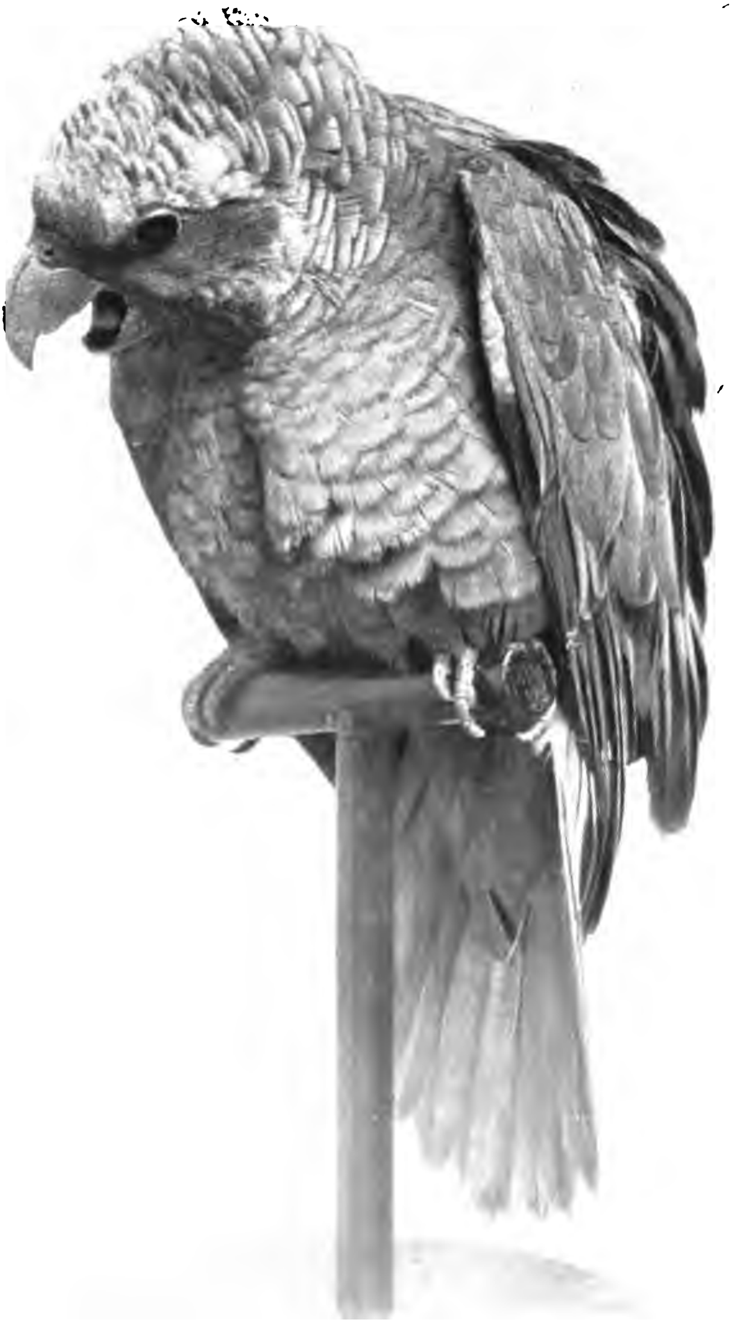
Reproduced from a photograph lent by Dr. R. Bowdler Sharpe, keeper of the Department of Ornithology, British Museum.



A SCOLDING PARROT.

From photograph of a specimen in the U. S. National Museum. (Cat. No. 126612, U. S. N. M.)

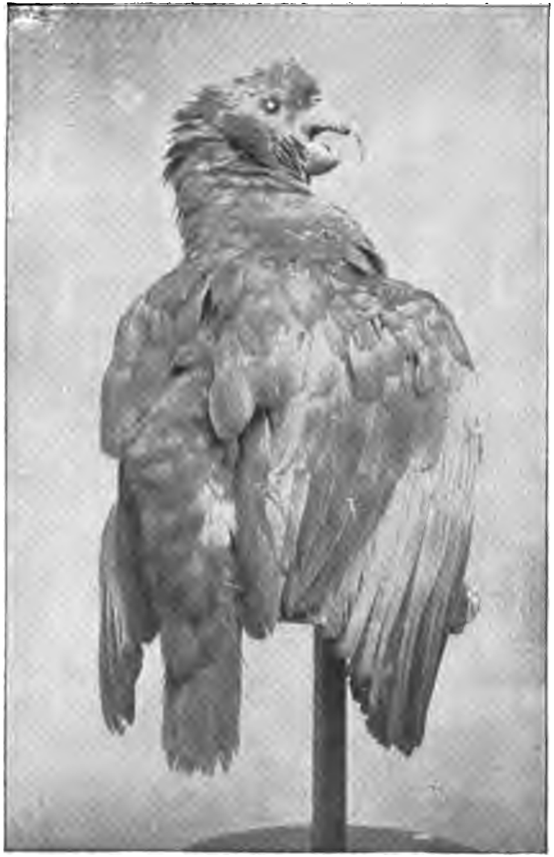


Fig. 1. Rear view.

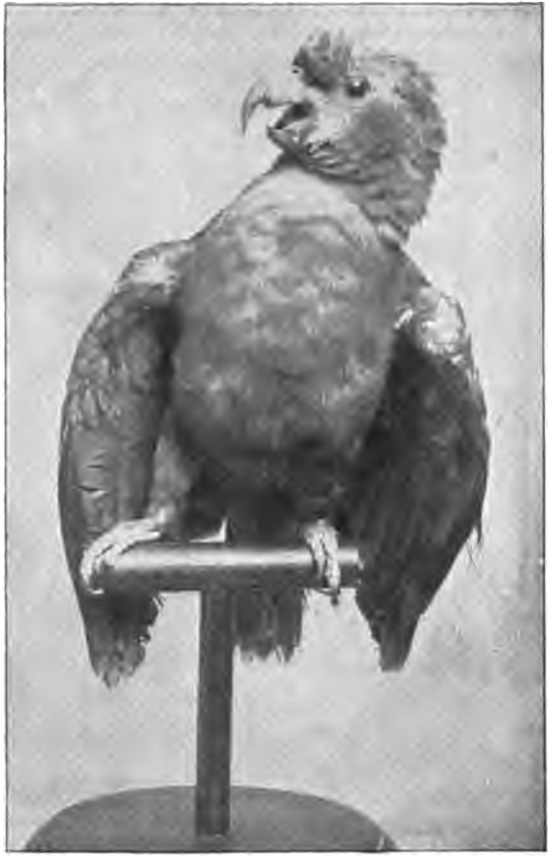
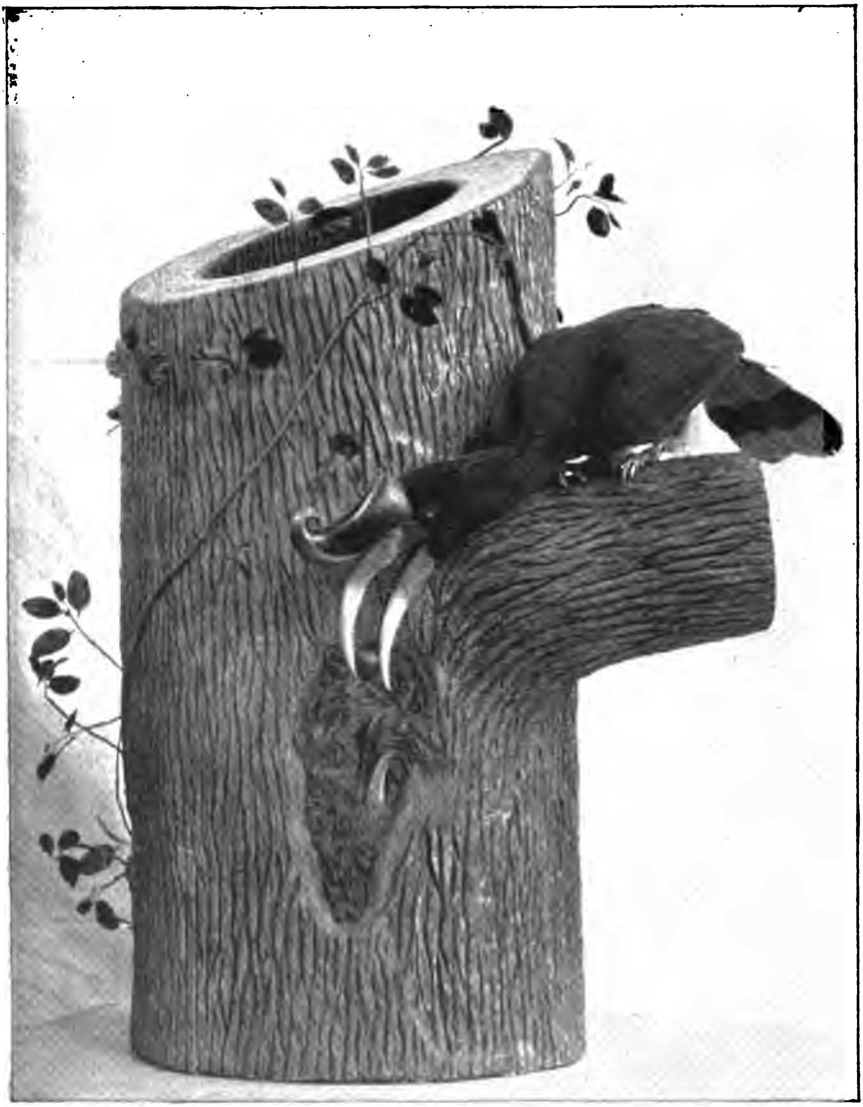


Fig. 2. Front view.

Parrot on the Defensive.

(Cat. No. 124987, U. S. N. M.)



MALE HORNBILL FEEDING IMPRISONED FEMALE.
(Cat. No. 116621, U. S. N. M. Collected and mounted by Mr. C. F. Adams.)

partment is growing up at the Government museums, and this in the field we now have under consideration, and it is the exhibition of the finest possible specimens of all our domesticated fowls, especially pigeons, chickens, and the like. So far as the art has applied itself to the preservation and representation of these lately, it has been most satisfactory, and many masterpieces of this kind now adorn the series.

The style in which the fowls are being done is well exemplified in Plates XLVI and XLVII. Mr. C. A. Sharp, of Lockport, N. Y., imported the birds there shown from England. They are both prize-winners, and both splendid samples of Indian game fowl, cock and hen. At their death they were presented by Mr. Sharp to the National Museum. "Lady Whitfield," the hen, is an hundred-dollar bird, while her consort brought $350. From an artistic point of view, in so far as taxidermy is concerned, they are markedly superior pieces of workmanship and in every particular—pose, topographical anatomy, coloring, spirit, and all. To appreciate their beauty, we have but to compare them with some of the taxidermy that was done during the old régime of the Museum's history. I mean such types of it as I am enabled to show in Plate XLIX, Fig. 2—a White-faced black Spanish cock—a relic I exhumed from the vaults of the specimens now being discarded. What a beauty (?)—saddle-backed, tail thrown up like a toucan's, wires showing everywhere, most all of his body in front of his legs, stepping off with both feet flat on the ground, and such a weird, grotesque, consequential, lop-sided aspect anyway—this fright with no form of a fowl known to me is only fit to grace the front window of a fourth-class cheap bird "stuffer's" shop. A few more such "spooks" as this still linger on exhibition, as if by courtesy to the past, but they will shortly have to make way before the work now coming in.

Sometimes these game cocks are "undubbed," that is their wattles and comb are not trimmed off. In preserving these parts in a bird like this they are cast from the original and restored in a plastic material, that will keep indefinitely without change of form or color. After the bird is mounted, these are properly attached in their places on the head, and the suture lines colored over. The effect is absolutely perfect, and to show how perfect it is I have introduced two additional figures, nearly life size, of the head of a game cock (Plate XLVIII, Figs. 1, 2). They will bear the minutest inspection from every critical point known to taxidermists. In Fig. 2 the eye is unfortunately marred by the light refraction, but we can not avoid that in photography. Thoroughly lifelike again is the pretty specimen shown in Plate L, a Silver-spangled Hamburg hen. The artist who mounted this specimen is a close student at all times of the various attitudes assumed not only by fowls and pigeons of all kinds, but of the feathered creation at large, and in this instance has happily hit the appearance of a hen feeding as she walks along or regarding some small object on the ground that has attracted her attention.

Another worthy subject is seen in Plate XLIX, Fig. 1, a proud old black Sumatra cock, that comes from a line of fowls unsurpassed by any in beauty or from. Mr. Wood, of the Museum, owns one or more of the grandsons of the rooster here portrayed, and through the skill and patience of Mr. T. W. Smillie, in charge of the photographic gallery of the National Museum, I am enabled to present figures from photographs of this cock, taken from the live bird.

They are valuable as models, going to show the disposition of plumage, the contour of general form, its attitudes, and general appearance. These fowls are black all over, with strong blue and green reflections in every changing light. Special attention is invited to the elegant manner in which the superb tail is horizontally carried and the proud carriage of the bird in Plate LXI. O ye artists of the pen and block who diligently illustrate for our thousand and one agricultural periodicals all over this country, and sometimes do not quite hit in your efforts the galline form divine, pray look upon these portraits before getting down to your easels again, and profit thereby!

Other remarkably fine pieces of work of this kind are seen in Plates LII, LIV, and LV. They are all equally good and deserving of the highest compliment that I can give them, and that is they are absolutely true to nature. My only regret is that they are not colored as well, for they would then be still more lifelike and their real beauties greatly enhanced. This factor is not so much missed in the good old light Brahma hen in Plate LV, for she is largely black and white. She was presented to the National Museum by Mr. Charles Griffin, of Shelter Island—with the cock that goes with her they constitute a pair of fowls of great beauty. (Plate LIV and LV.)

Many of the domestic pigeons have also been treated at the Museum quite as artistically as have the fowls. No opportunities have been lost to catch these in their every mood, and reproduce them in preserved specimens of the individuals themselves. One of the prettiest subjects sent on to the Chicago fair by the National Museum was a large pigeoncot covered with many varieties of our tame pigeons, both the common and the rarer kinds. It was gotten up by Mr. Lucas in a manner that admitted of no improvement, bearing as it did a true likeness to an original. Two of the pigeons that were upon it are shown in Plate LVI and LVII. When one thinks of the stiff and uncouth things that so many taxidermists give us and call them pigeons, it is positively grateful to turn to these here shown, and observe the eminently natural attitudes in which these gentle creatures have been thrown. One of the prettiest pieces of taxidermy that I have ever had the pleasure of studying is the dozing dovecot pigeon, depicted in Plate LVI. We hope that this collection, now so well advanced, will continue to grow both numerically and in the variety ot the species. Were it possible to obtain some of the steps in Mr. Darwin's numerous experiments with pigeons, and all that he demonstrated thereby, and the corresponding forms and

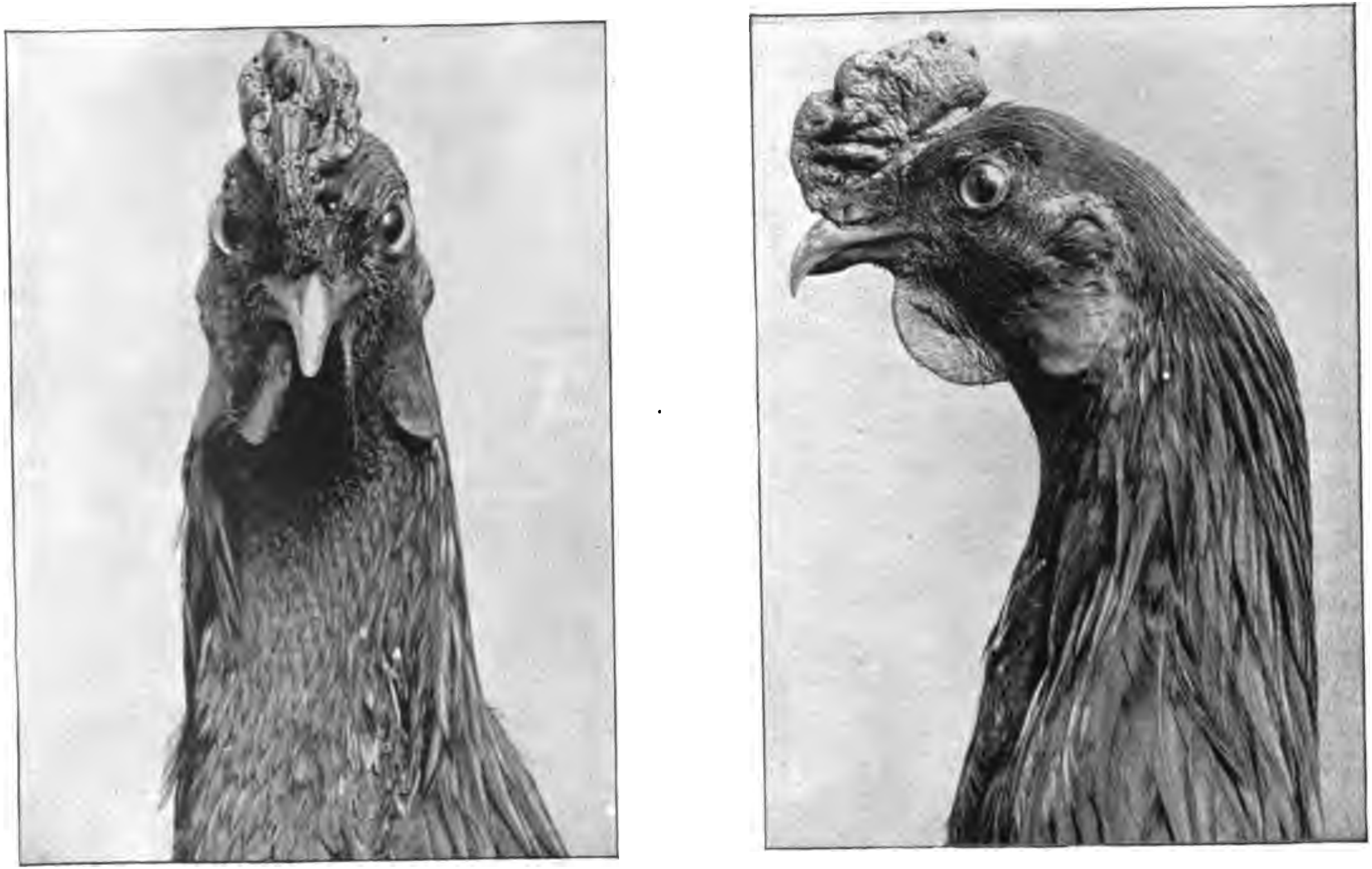
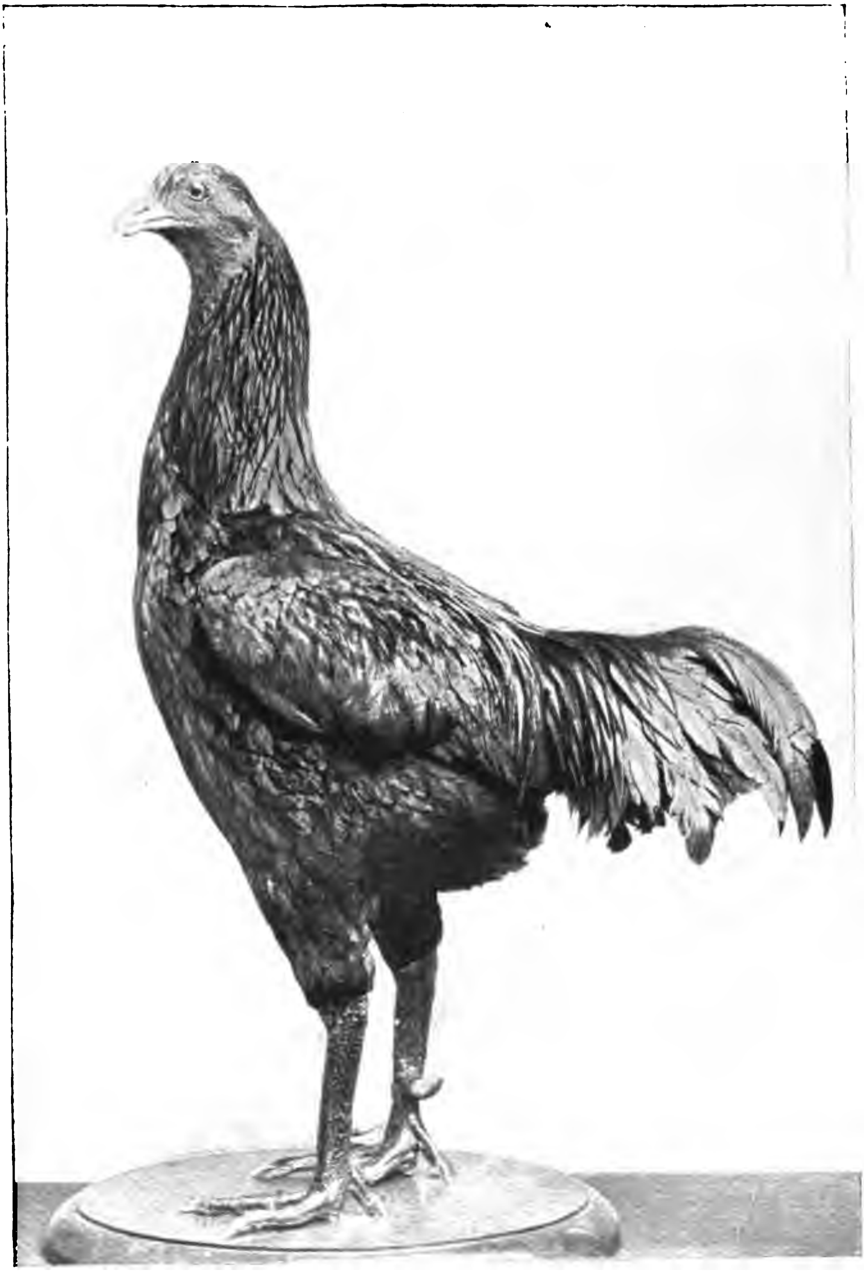


Fig. 1. Front view.

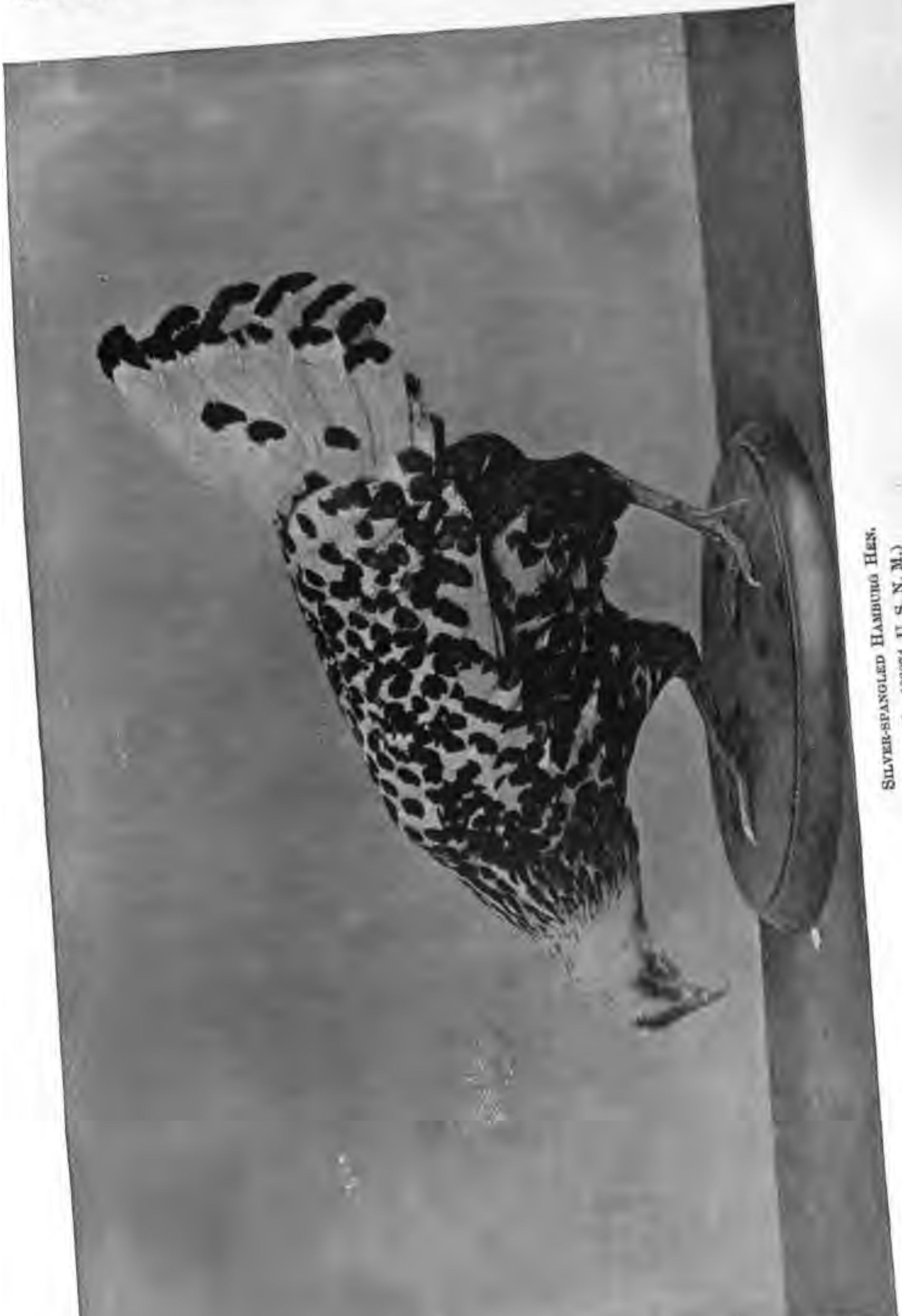
HEAD OF INDIAN GAME COCK (UNDUBBED) NEARLY LIFE SIZE.

(Cat. No. 106080, U. S. N. M.)

Fig. 2. Lateral view.

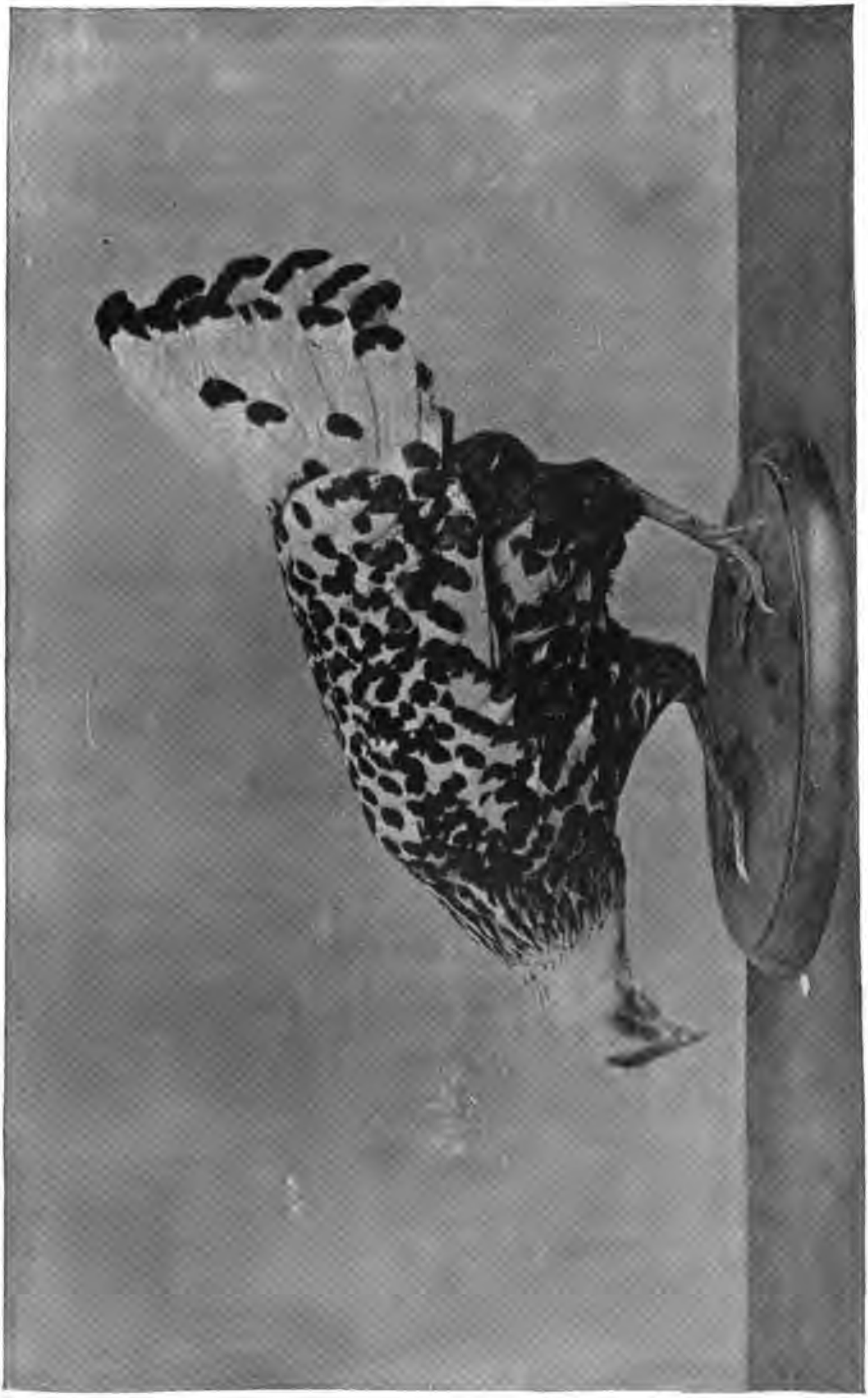


INDIAN GAME COCK (dubbed).
(Cat. No. 106079, U. S. N. M.)



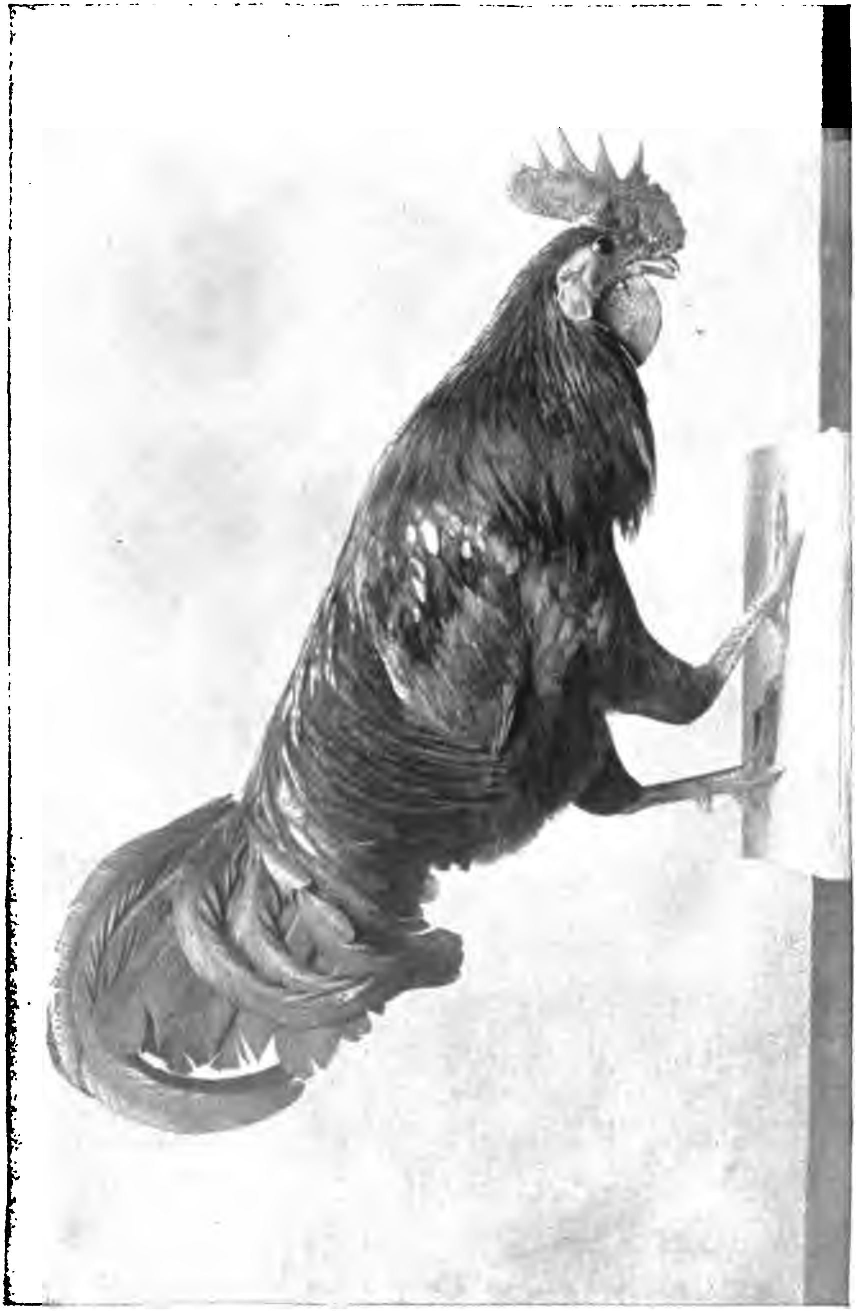
SILVER-SPANGLED HAMBURG HEN.
(Cat. No. 106074, U. S. N. M.)

PLATE L.

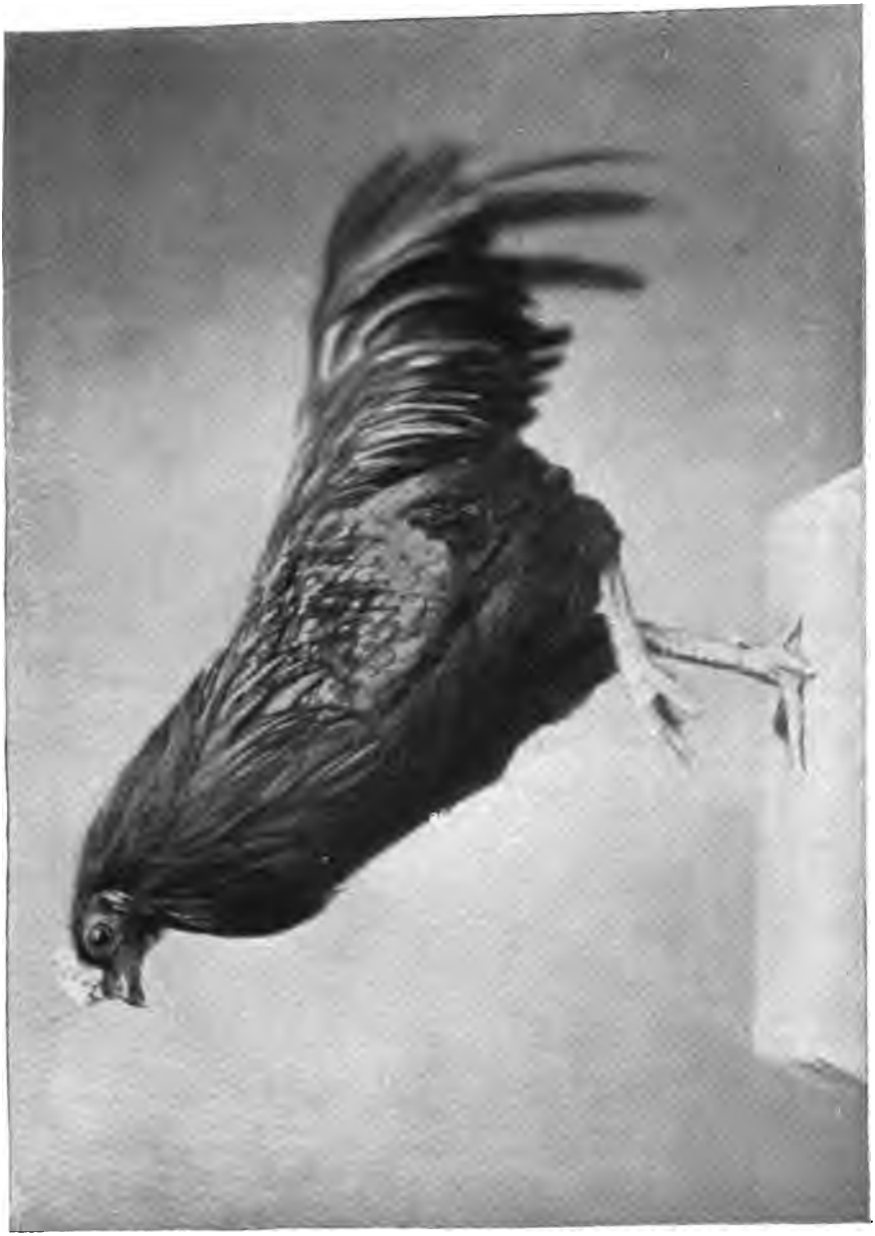


SILVER-SPANGLED HAMBURG HEN.

(Cat. No. 106074, U. S. N. M.)



Brown Leghorn Cock. (Calling the hen.)



Black Sumatra Cock. (Attitude of rest on one foot.)
(From photograph of living specimen, lent by Mr. Nelson R. Wood.)

crosses could be obtained, the plan would not be a bad one to devote a few cases to illustrate so important a subject.

When we come to study the collection of mounted specimens of the Gallinæ in the ornithological cases of the Smithsonian Institution in the large hall where all the mounted birds are exhibited, we find the same condition of affairs presented to us, as has been described for the other avian groups. Inferiority of work, as a rule, characterizes the older specimens, while real merit marks the most of those that have appeared within comparatively recent times. This appears to have been the case, in so far as the latter kind are concerned, during a period extending over perhaps a twelve month prior to the opening of the World's Columbian Exposition. Some fine work began to make its appearance just then, due apparently to that cause, which was having a similar stimulating influence in all quarters, no art or industry being exempt from it. The advances in methods and results was being silently watched by me with a keen interest and appreciation, not to say a feeling of pride and exultation at the genuine gain that was being made in such matters.

My attention, among other things, was especially drawn towards the group to which allusion has just been made, particularly the American partridges and grouse and their allies. Some of the species of partridges that were being mounted and placed in the cases struck me as being more life-like than was common, and I mentally compared them with my recollections of the living species in nature, as well as all the figures I knew of them. As the present paper began to take on form I determined, if possible, to introduce copies of a few photographs of living partridges, and, as has been mentioned on a previous page, the opportunity was duly presented. Mr. Smillie was good enough in my presence to make several exposures upon a living specimen of Gambel's partridge, and some of those results are well worthy of publication. They are presented in Plate LIX, Fig. 1, and Plate LX. In the first figure the bird had elevated all his feathers just prior to preening himself. This in a way should be compared with the quail shown in Fig. 2, recollecting, however, that the living bird is not on the ground and that the mounted one is done with the act of preening and is just about to shake herself.

In Plate LX the bird was taken as it sat quietly upon a perch, and slightly elevated the feathers at the neck and forepart of the body. It shows that one of the feathers of its plume was broken and hung down below the others and is not a shadow, as might by some be supposed. This figure is a fine model for those whe may desire to mount a partridge in this attitude. Although of a different genus, it is interesting to compare this with the partridge shown in Plate LXIII, which is one of the best mounted specimens of a *Colinus* with which I am acquainted. It will be noticed that the slight flatness that naturally exists over the pectoral region is apparent in both the living bird and in the specimen shown in Plate LXIII. This feature should also be compared with what we see in Plate LX.

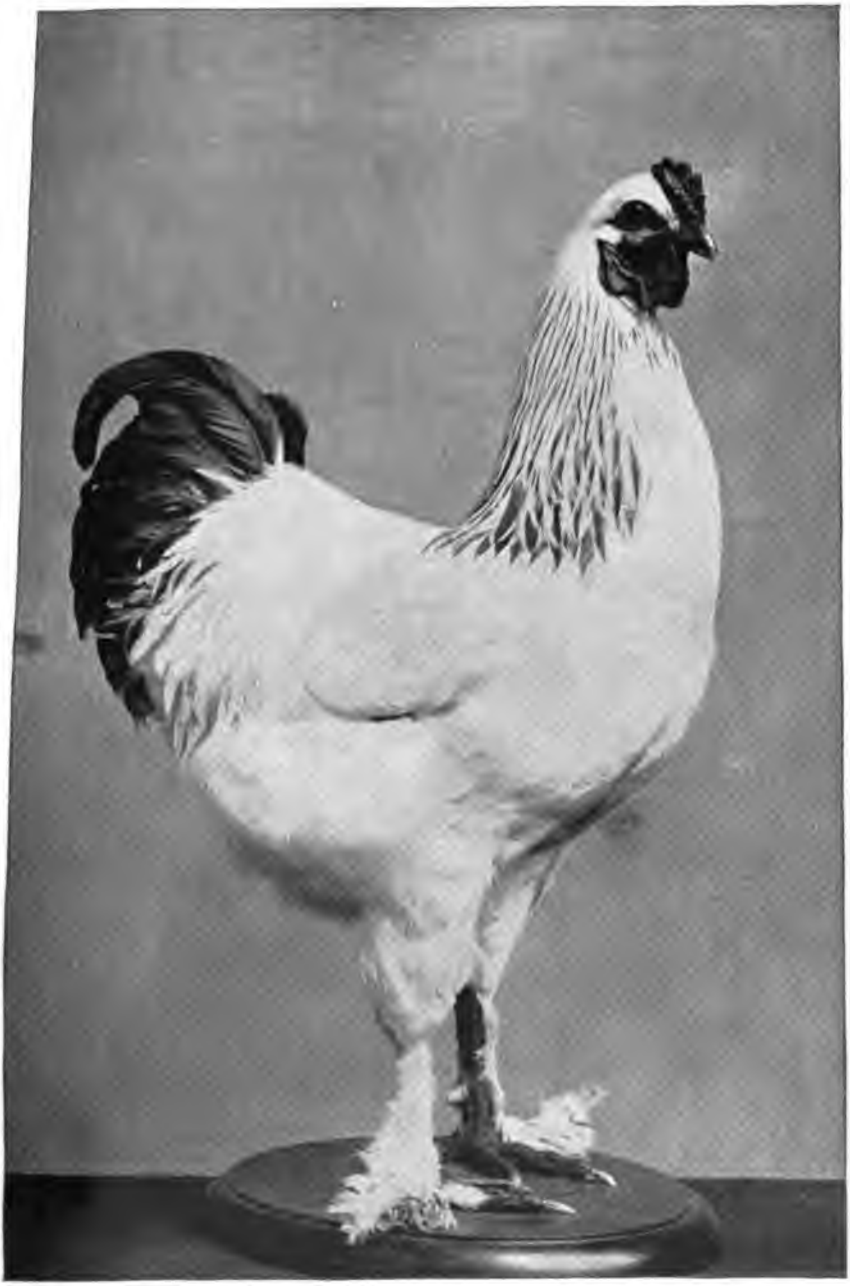
Some excellent judges of the taxidermy of birds have spoken very highly of the California partridge shown in Plate LXI, and though apparently in all essential respects faultless in workmanship, design, and execution, it is to me not as pleasing a result as the *Cyrtonyx* seen in Plate LXII. Birds of the latter species I have seen in New Mexico, and in nature they exactly have the form here shown. The model used in this case, however, was from the figure in Gould's monograph on the *Odontophorinæ*, while in the case of the California partridge it was from life.

Of the larger game birds the Museum has quite a number of a character not to be excelled by any institution in the world, and probably not fully equaled by any other in this country. They must excite even the admiration of those who care ever so little for either ornithology or for the feats of pure art in taxidermy. But such people, fortunately, I am not now dealing with and care less for. But tell me, where is the naturalist, or the sportsman, or the taxidermist, or the cultured anywhere who can not see the extreme beauty and excellence in such specimens as I have been permitted to present in such a piece as the Pheasant portrayed in Plate LXIV, or the moor cock shown in the next plate following, or Plate LXV. It is too bad we can not show the color in such a specimen as this, for it is surely a gorgeous fowl. There is another specimen of the moor cock in the collection and the taxidermist has attempted to mount it in an attitude of strutting on a log, or a large bough, I do not remember which now, for I only remember the unpleasant sensation left upon me after having seen the bird itself. It has the appearance as though it was about to have a spasm. It is an excellent example of—very bad taxidermy.

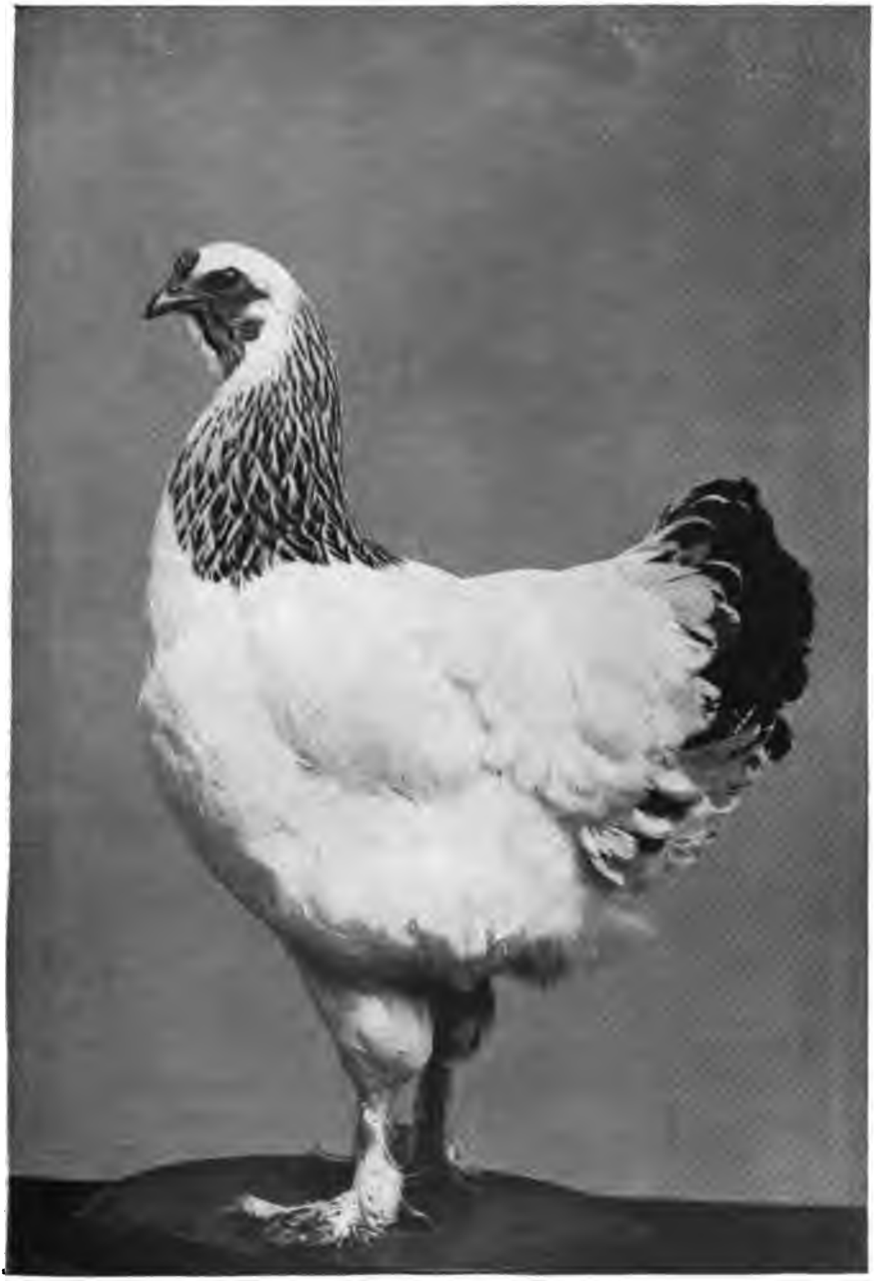
Wolf's superb drawings form almost an inexhaustible supply of graceful and accurate postures and positions of all kinds of vertebrates, and it was from that work that the artist secured his model for the Ruffed grouse reproduced in Plate LXVI. In placing this, however, before the camera I gave it a front view rather than a lateral one, this being, as is well known, one of the severest tests to which you can submit the artist's work, especially in a piece of this kind. How well it stands it others must be left to judge; for my own part and in my humble opinion it represents to a line, to a feather, a startled grouse as he regards from the bough of a tree the object that has alarmed him. The balance, with upper wing slightly lowered, with tail flatly outspread raised ruffs, and eager look, the position of the feet—indeed the entir poise is admirable throughout.

In order to show how well some of the other species of our grouse hav been preserved I chose the two shown in Plate LXVII, Figs. 1, 2, either o which are as good as they can be made. It would have been an eas matter here to have selected a dozen or more mounted specimens o grouse from the collection that would have shown how bad these bird

PLATE LIV.



Light Brahma Cock.
(Cat. No. 106043, U. S. N. M.)



LIGHT BRAHMA HEN.
(Cat. No. 106044, U. S. N. M.)

can be mounted when they fall into the hands of the unskilled. It is better, however, I think to forget and forgive all that has been done in the past, provided we continually strive to copy nature as closely as possible in the future. To this end I reproduced as many good models as possible, and have given only a few showing how taxidermy ought not to be done. Examples of the "how-not-to-do-it" kind have been introduced here and there only as warnings.

Our wild turkey seems always to have given trouble to the old-time taxidermists, and some perfect frights are made to do duty for that noble fowl in the collection. Some of these are so badly prepared that they are downright hideous, while in some respects they fail to give any idea of the bird or its appearance in nature. The taxidermy of the turkey, moreover, presents difficulties that are to be encountered only in a limited number of birds in any avifauna. Chief among these problems is the proper preservation of the practically featherless head. This is not only without feathers, as we know, but in life is highly colored, corrugated, and wattled below. Whoever it was that prepared the turkeys in former times that now disgrace the cases of the ornithological department I do not pretend to know, any more than I know the reason why such miserable fifth-class pieces of work are retained there, unless it be something after the order of Chinese ancestry worship, and an opposing of the methods of the moderns.

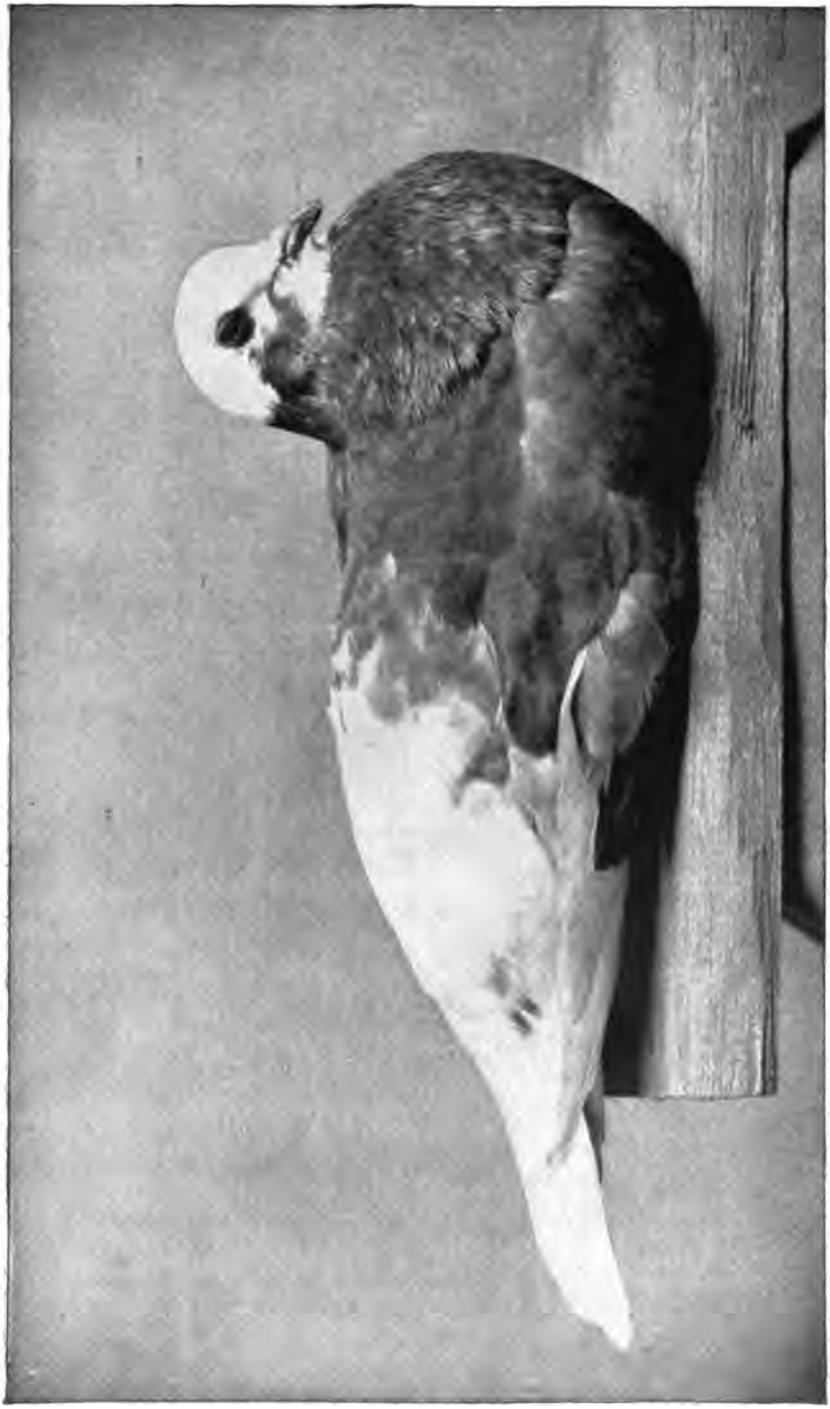
To condemn the bad and to recommend every result that reproduces nature is my object here, and this thought was uppermost in my mind when the comparison made in Plate LXIX was undertaken. As one looks at this plate the left-hand head shows how wretchedly bad meleagrine taxidermy may be done sometimes. The wattle-like comb has had no pains whatever taken with it, and appears more like a curved, semi-erect, filamentous horn than anything else; the skin of the head has been stretched down an inch lower than it belongs, rendered possible by the "stuffer" eliminating all the corrugations that naturally occur in it; then the feathers that belong on the back of the neck are twisted round to the front. After it was dry he further insulted the poor bird by blotching his neck all over with red, white, and blue paint—patriotic, but a villainous practice notwithstanding.

Compare this with the second head in the same plate. In the first place it is perfect in form, and all the parts are naturally disposed. This bird's head is restored in wax—that, is the skin of it is, together with the comb and antero-inferior wattles. In this the proper colors have been so adroitly incorporated that the effect produced is life-like in the highest degree. Even the little hair-like feathers have been by a process of the art normally scattered in their places over the head. The remainder of the bird is prepared quite in keeping with this truly beautifully preserved specimen. An old gobbler of this species is shown in Plate LXVIII. He is mounted in the act of strutting, and the models for it have been furnished principally by the act as it is performed by the domesticated bird. I consider this to be one of the finest pieces of modern taxidermy, so far as birds are concerned, in the museum. The arrangement of the exceedingly profuse plumage is perfect; the markedly oblique tilting of the spread tail, a feature that it is difficult to appreciate in the plate, is most truthfully rendered. This bird's head was prepared after the usual methods, but I understand it is contemplated to model it in wax, like the one just described above. When this is done I believe the National Museum will possess the finest specimen of a mounted wild turkey in existence.

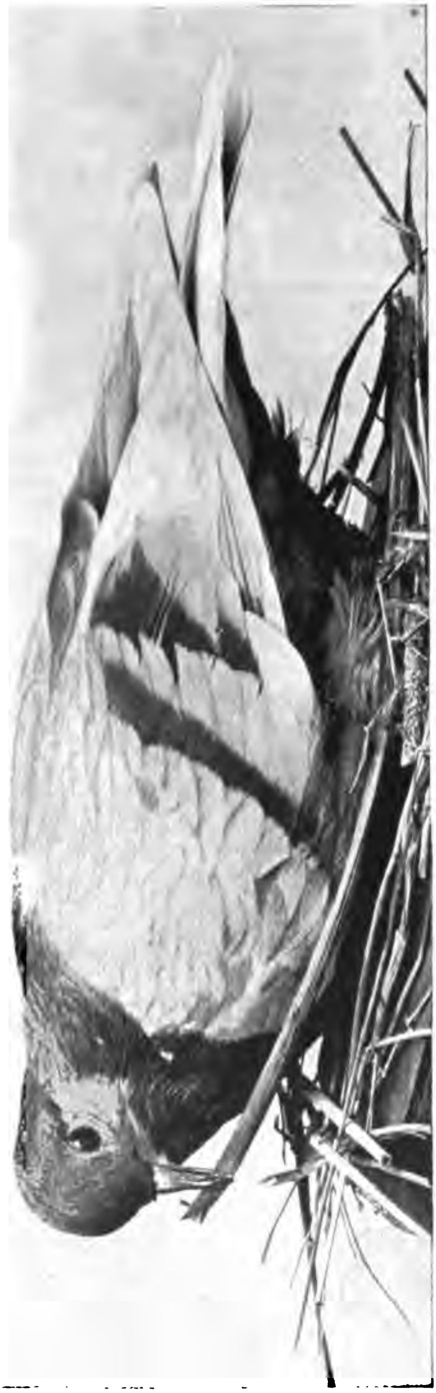
Owls have not only given a great many artists infinite trouble to correctly portray, but they have likewise been placed upon the black list of a perfect host of taxidermists. Literature illumed by plates of birds goes to show that many an ornithologist who could draw and paint nearly every other kind of bird failed when owls were essayed. So, too, there are taxidermists who can mount most all birds correctly, who fail to a large extent when they take any of the *Striges* in hand. Wilson, the American ornithologist, used to complain bitterly of his inability to figure any of these birds exactly to his liking, and even the master, Audubon, shows a little weakness sometimes in such directions. Now, in my first attempts at the photography of birds, owls were the subjects, and one might think, inasmuch as they quietly roost and doze nearly all day, that is, the strictly nocturnal species, they would be easy subjects, but this is by no means always the case. A number of years ago, in New Mexico, I frequently tried specimens of Aiken's Screech owl (*Megascops asio aikeni*), but the results obtained were never entirely satisfactory to me. I have kept many kinds of American owls alive in my lifetime, and these screech owls have a habit, common to some other species during their dozing hours during the day, of drawing themselves up in an erect attitude, with all the feathers compressed against the body, and with the plumicorns erected to their fullest extent. But when we come to try and photograph one in such a desirable attitude, we must, to get him anything like life size, get the camera within a very few inches of his owlship, and this almost invariably alarms him, and he will flatten out his plumicorns, puff himself up, and then, after a second's idiotic stare, fly to some other part of the room. Photographing them at a longer distance makes the figure of him too small.

I was once a whole day here at Takoma endeavoring to secure a photograph of one of our Common Screech owls (*Megascops asio*) in my room—and then failed. He would jump up on top of my camera, emit a loud, rolling whistling note of disapproval of the procedure, dash off and finally nearly brain himself by bumping into the mirror of my wardrobe. I'd hypnotize him, stand him on the perch, and disappear for half an hour, and on my return he would be standing up as straight as a rocket in just the position I wanted him, but all my efforts to sneak up to the camera and remove the cap and make the necessary exposure failed

PLATE LVI.



COMMON DOVE-COTE PIGEON. (Dozing.)



COMMON DOVE-COTE PIGEON.

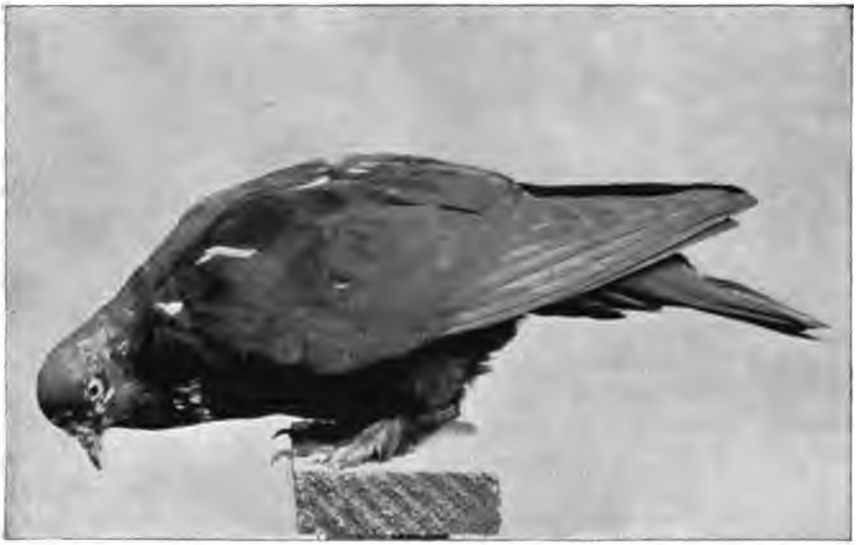


Fig. 1. PIGEON. BLACK OUTSIDE TUMBLER, ♂.
(Cat. No. 106100, U. S. N. M.)

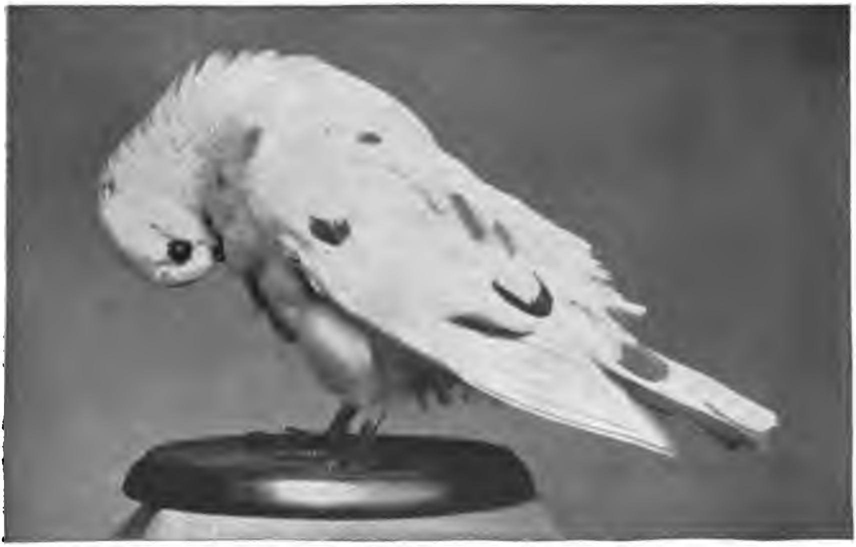


Fig. 2. DOVE-COTE PIGEON. (Act of preening.)

utterly, for he would reënact the same performance I have just described. Finally I tied a piece of strong pack thread to his leg and took him out of doors, took him in the broiling glare of the sun, and giving him a blotting-paper background and a pretty perch, I went at him again. After numerous attempts I secured the fairly good result shown in Plate LXX. When obtained he was staring his eyes out at a chicken that was making a disturbance not far away, and with a pin-hole diaphragm in, I gave him an exposure of at least ten seconds, during which time he never moved. His right foot exhibited an old dislocation, and its twisted position is evident in his picture. I am indebted to Master Richard Lay, of Takoma, D. C., for the loan of this bird, for which and for his trouble in capturing it for me I desire here to express my grateful acknowledgments. It is my intention to experiment with the photography of owls until I succeed in getting a fine series of them in all possible poses, with the hope that when duly published they will prove useful to both artist and taxidermist. On a former page I have invited attention to the picture of the owl shown in Plate LXXII. It is a plate made from a photograph of a drawing that was accurately copied from the original photograph of the bird, and is a good result and ought to prove useful both to the artist and to the taxidermist. This pluffing up of the feathers in *Bubo* is common practice with them, and the act, to a moderate degree, has been well rendered in the exceptionally fine mount of one of the bubonine owls which I offer in Plate LXXI. It shows the bird in what might be called the first stage of observant defiance, or when something, evidently not of a pleasing nature, has attracted his attention and he is "getting on a ready" to repel it. The original has but to be seen to be admired, for it is remarkably well done.

There is not much encouragement to the taxidermist if the ever present fact is before him that the work with which he has taken so much pains, and given so much of his labor, is at last to be but poorly exhibited; that is, his birds are to be huddled together in small and unsuitable cases, and those in an illy-lighted hall. Unfortunately this is just what exists in the ornithological department now in the old Smithsonian Institution building, where certainly 50 per cent of the room space is particularly not of the proper kind wherein to exhibit birds. This subject, though not altogether foreign to the present report, is in reality one that should be far more extensively dealt with than I will be enabled to do in this connection.

Of all the departments of the art of taxidermy none can exceed, and I doubt any can quite equal, the talent required to properly preserve mammals. This is due to the fact that in a vast majority of them the hair is sufficiently short to exhibit the anatomical contours of the body, head, and limbs, while in some the hair is practically entirely absent, and this very much increases the difficulty. The proper handling of the mouth and associated structures, of certain special organs, and of the feet and ears, etc., all conduces to this. And so, of a consequence, it especially devolves upon the taxidermist of the class of the vertebrata to provide himself with accurate drawings and with photographs of mammals, also with casts and figures of the skinned bodies and parts of bodies of his subjects. This is just what the sculptor is obliged to do in his art, and I remember very well, years ago, when I enjoyed the rare opportunity of watching Mr. John Rodgers at work in his studio. I have known him to carefully measure as many as thirty well-formed horses and take the average of those measurements so as to get at the data to model a handsome animal for a statuette of Washington. Not content with this, he had also in his room a complete series of plaster casts of the superficial muscles and other structures demonstrating equine morphology.

Further, all the principles I have referred to in the taxidermy of birds apply, almost without exception, to the class now to be considered. Groups are of especial interest where mammals are the subjects, and the National Museum has some of the grandest of them now on exhibition as a part of her mammalian series known to any institution of the present time. Take, for example, the group of American opossums in the collection. This was mounted by Mr. Hornaday, who has described it in the following words in his work on taxidermy. He says:

> The case which incloses the entire group is 4 feet long, 3 feet wide, and 3 feet high. The frame of the case is as light as possible, and all four sides and the top are of glass. On the side of a sloping bank stands the base of a small gum tree, with the roots on the lower side exposed by the crumbling away of the bark. Of course the trunk rises to the top of the case, where it is cut squarely off. At the bottom of the sloping bank between two of the roots is an opening, which is recognized at once as the doorway to the opossum's home. The burrow winds upward between the roots of the tree, and finally turns off to the left into the bank, where, after running through a passageway of 2 or 3 feet in length, the nest itself is found. It is in a pocket-like excavation, and a circular section is cut out of the front of the bank so as to make an opening through which the nest can be seen.*
>
> The nest is lined with dead leaves, in which lies an opossum curled up and sound asleep. At the back of the case a sectional view of the bank is represented, and by means of an opening cut here and there the course of the burrow is plainly seen. In the foreground is an old mother opossum with several young ones riding on her back, clinging to her gray coat, while the head of another protrudes from her pouch. This represents the manner in which the opossum carries her young after they have reached a certain age. From a small branch hangs another opossum, suspended by its prehensile tail, sprawling in midair. This specimen is a female, and shows the size and location of the wonderful marsupial pouch.† Another individual

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* This I take to be the only real defect in this otherwise masterly piece of taxidermic art. That cut, subcircular as it is, is constantly being mistaken for the real entrance made by the animal to its burrow, and what is the true opening between the roots of the tree often overlooked. The false cut should have been made on the end of the bank, where the side glass covers its supposed section, and we could have seen into the burrow through it. This can easily be remedied.

† This individual does not appear in the group as it is now exhibited, but forms a separate piece.

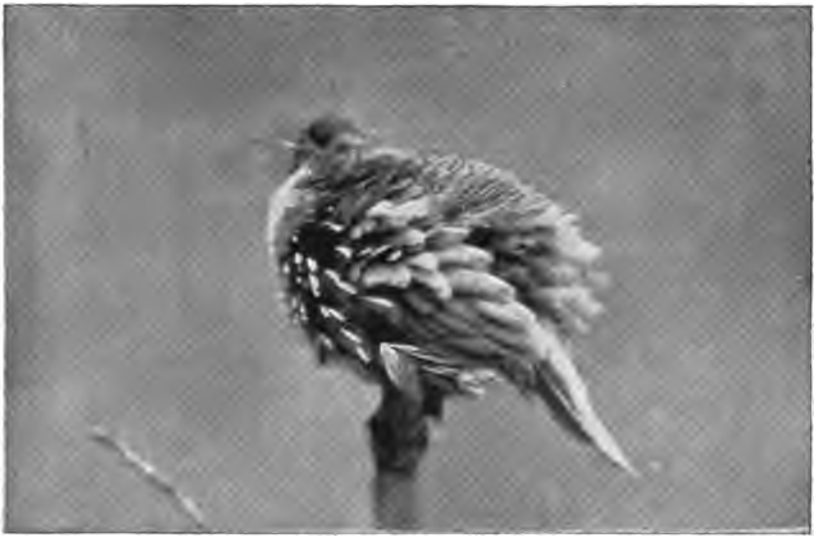


Fig. 1. **Gambel's Partridge** (*C. gambeli*, ♂).
Act of preening and elevating of plumage. (From photograph of living bird.)

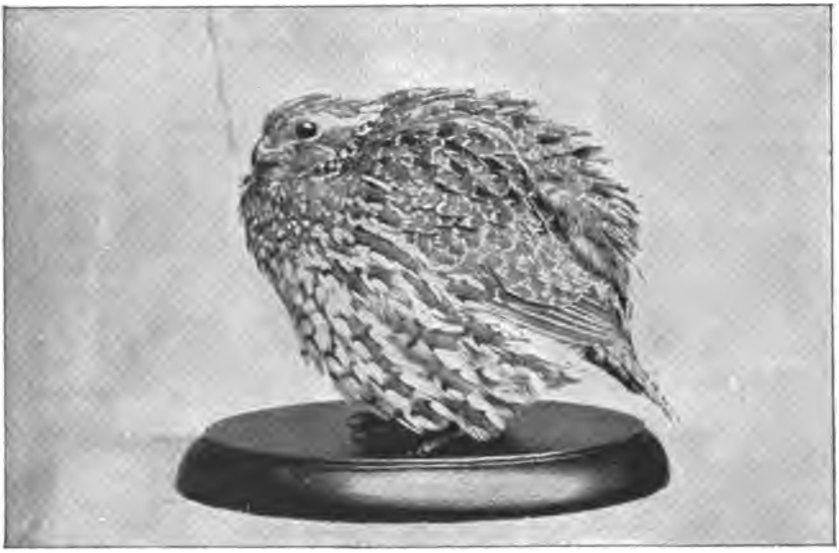
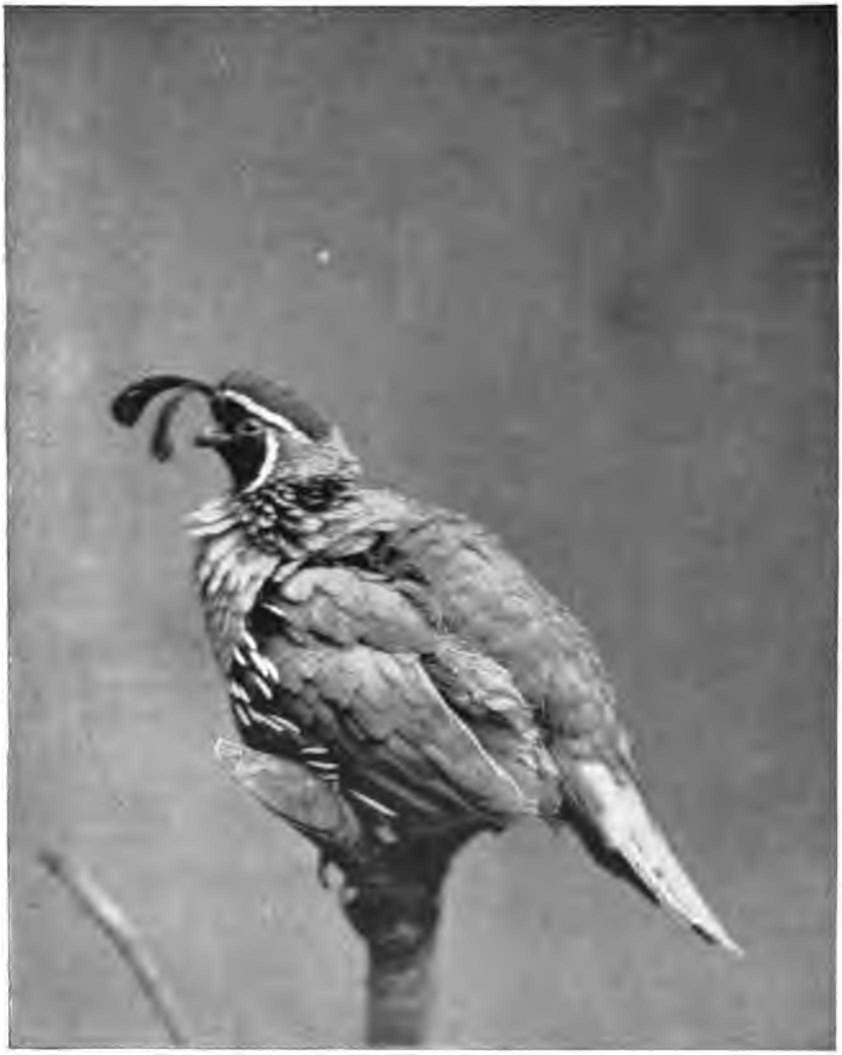
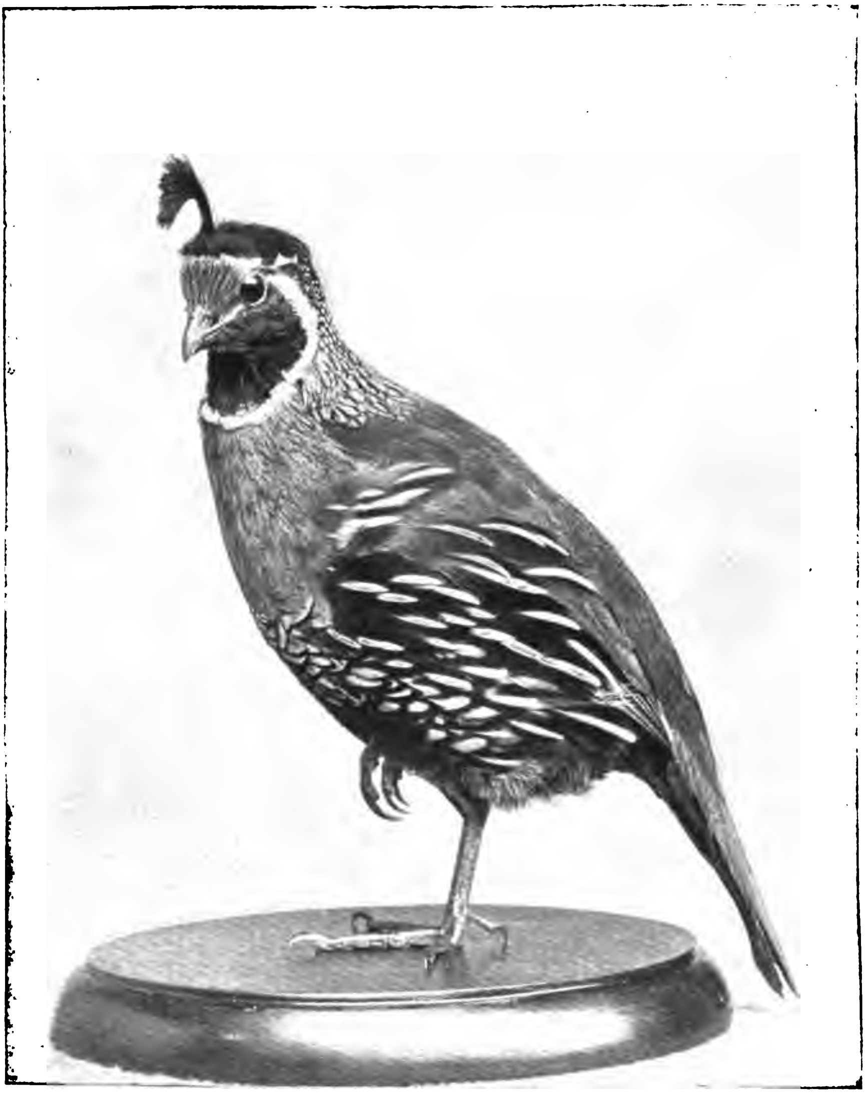


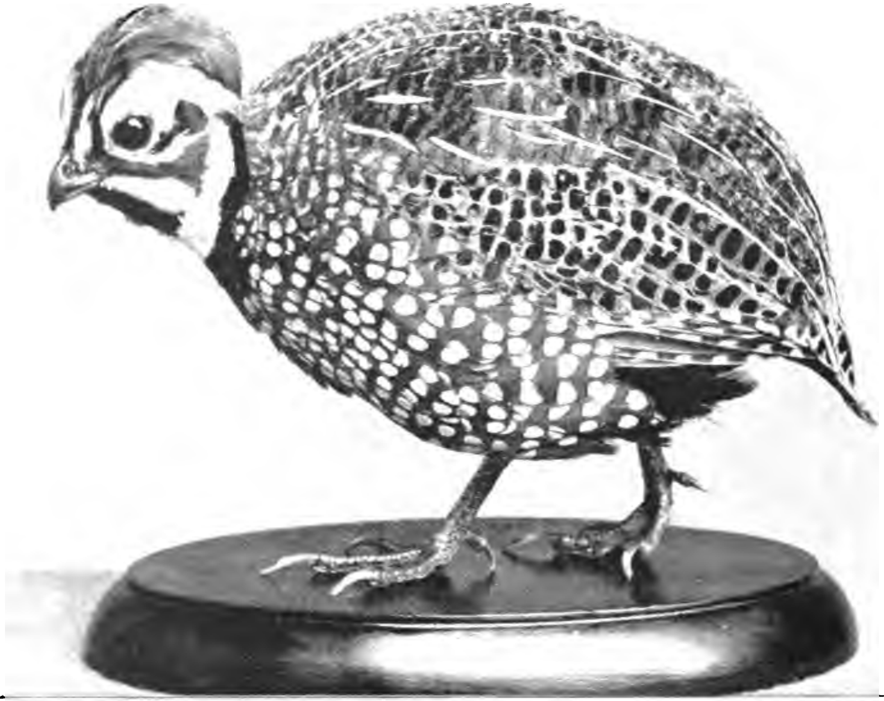
Fig. 2. **Quail** (*Colinus*, ♀).
Elevation of feathers prior to shaking herself. (Cat. No. 112923, U. S. N. M.)



GAMBEL'S PARTRIDGE (*Callipepla gambeli*, ♂).
(From photograph of living bird.)

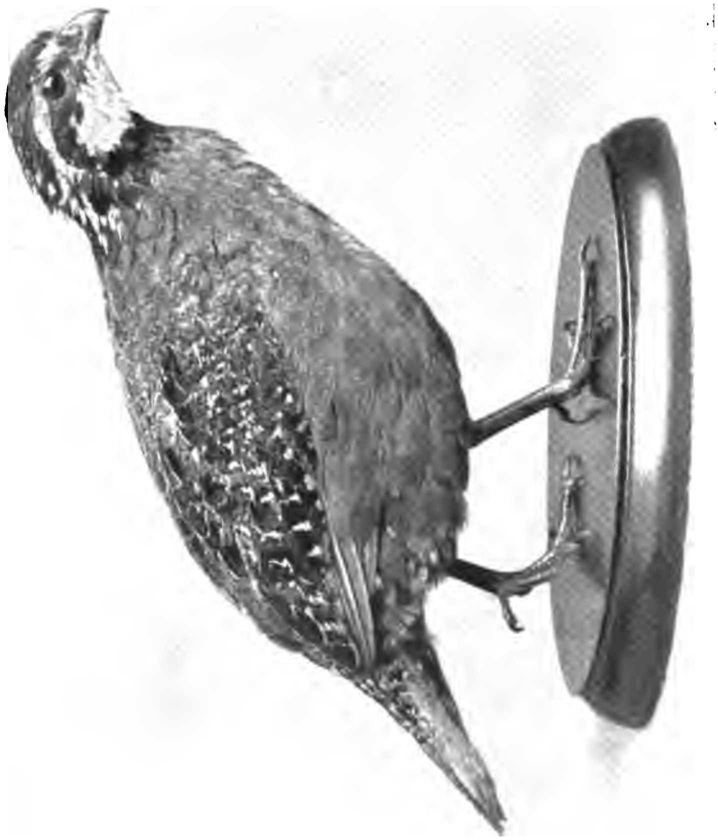


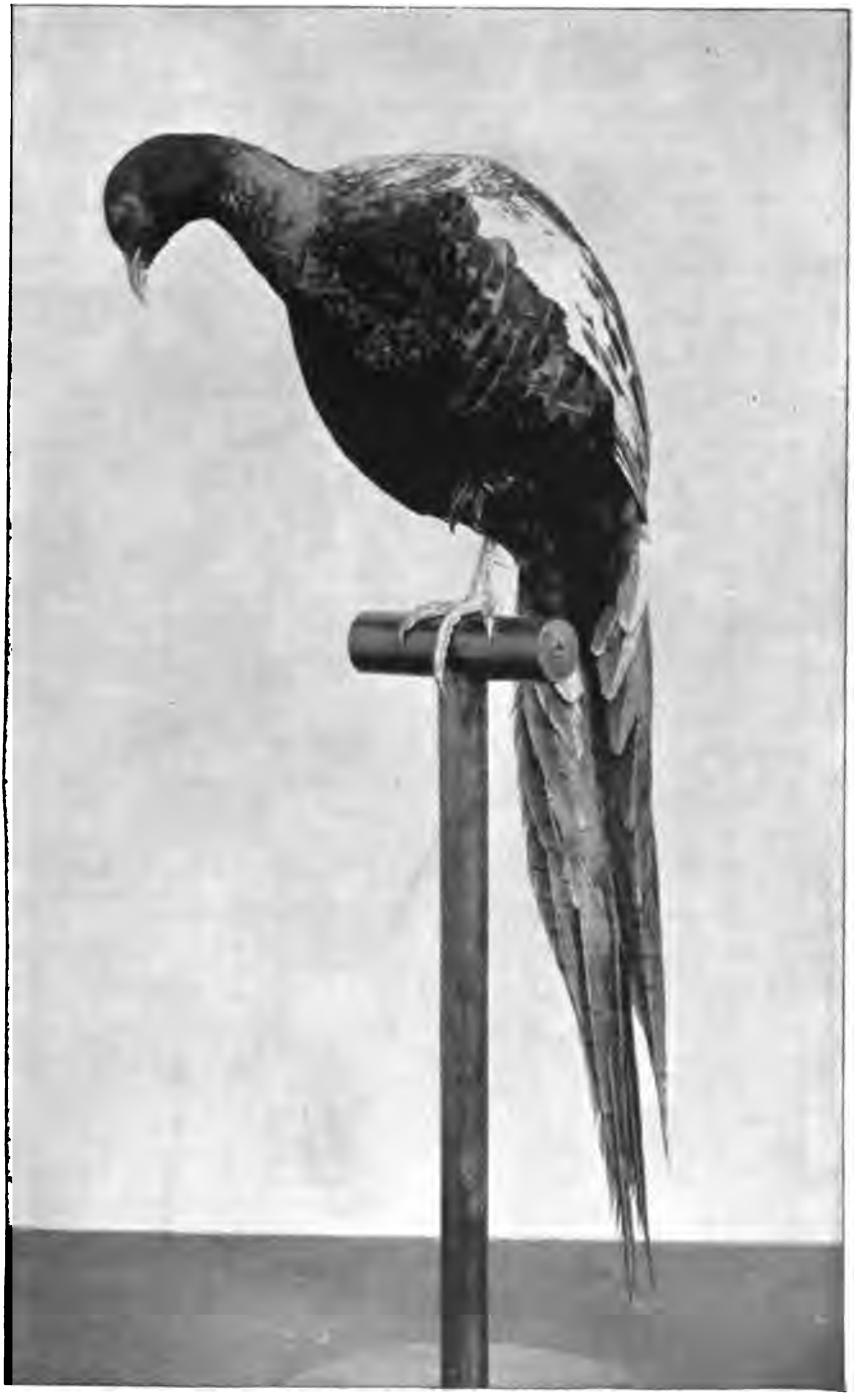
CALIFORNIA PARTRIDGE (*Callipepla californica*, ♂).
Reduced. (Cat. No. 107407, U. S. N. M.)



MASSENA PARTRIDGE (*Cytonyx montezumæ*, ♂).
Reduced. In act of walking. (Cat. No. 126502, U. S. N. M.)

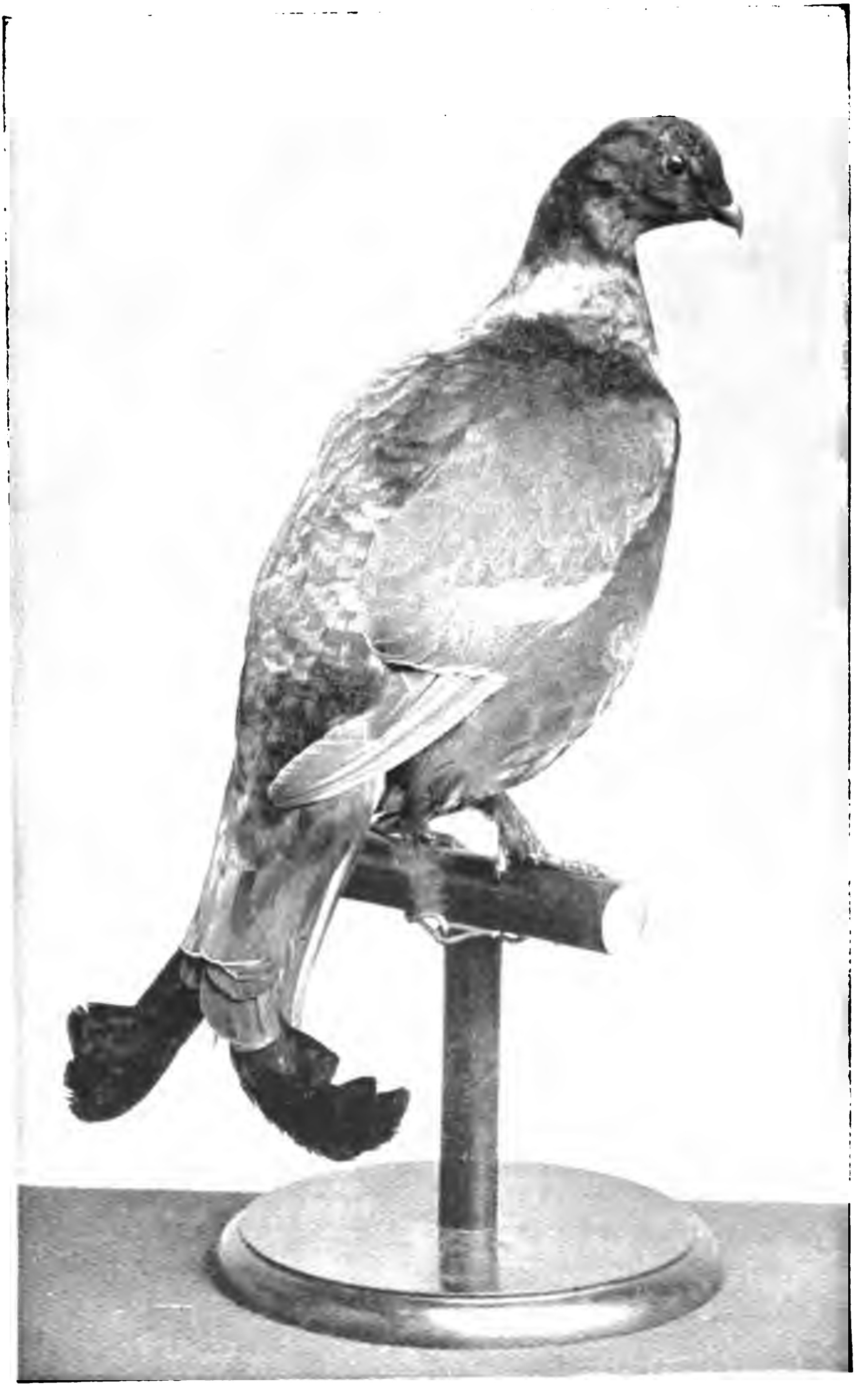
PLATE LX



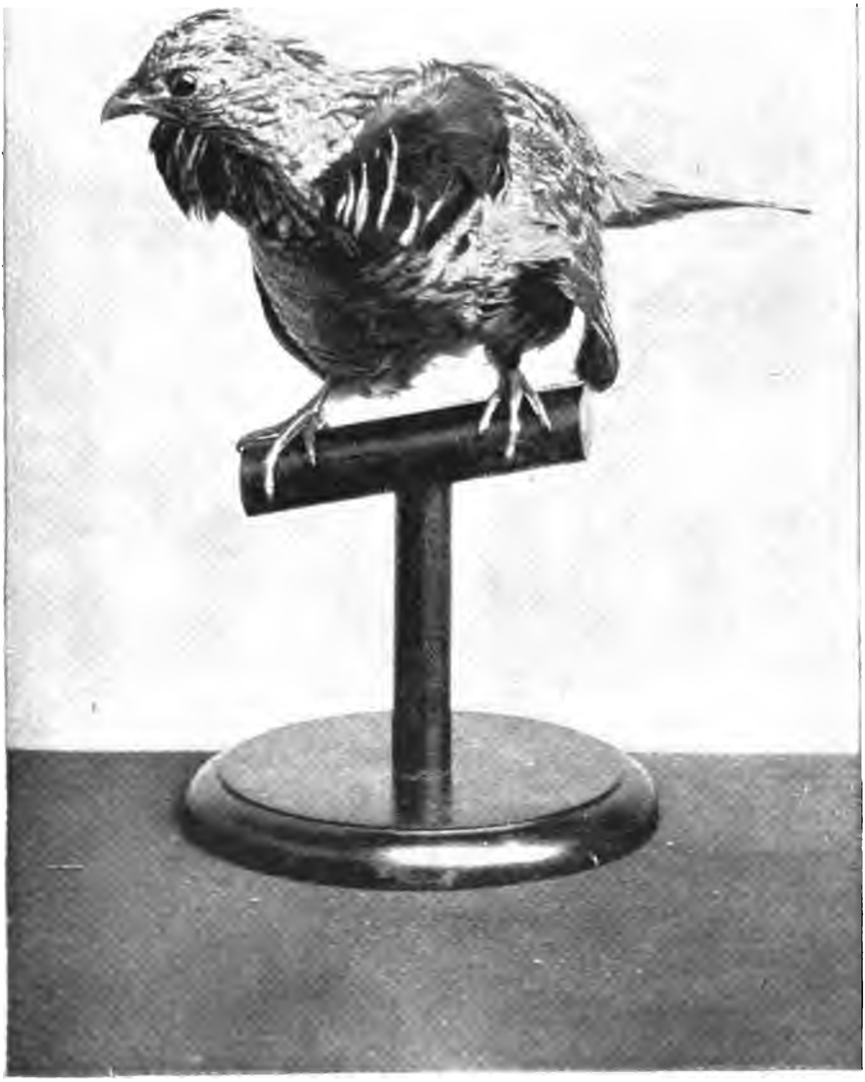


ENGLISH PHEASANT.
On elevated station, surveying objects below. (Cat. No. 116855, U. S. N. M.)

PLATE LXV.



MOOR COCK (*T. tetrix*, ♂).
Reduced. (Cat. No. 126574. U. S. N. M.)



Ruffed Grouse (*Bonasa umbellus*).
On bough. Reduced. (Cat. No. 87097, U. S. N.M.)

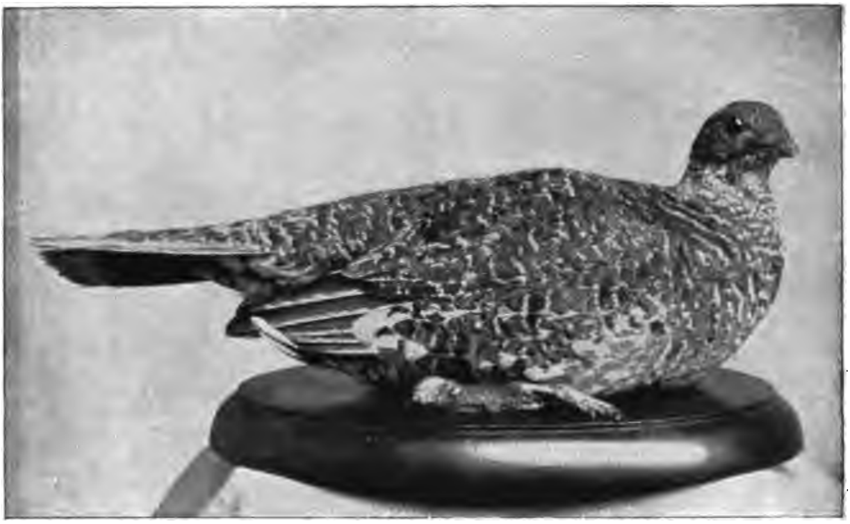


Fig. 1. DUSKY GROUSE (*Dendragapus obscurus*).
Reduced. (Cat. No. 112682, U. S. N. M.)

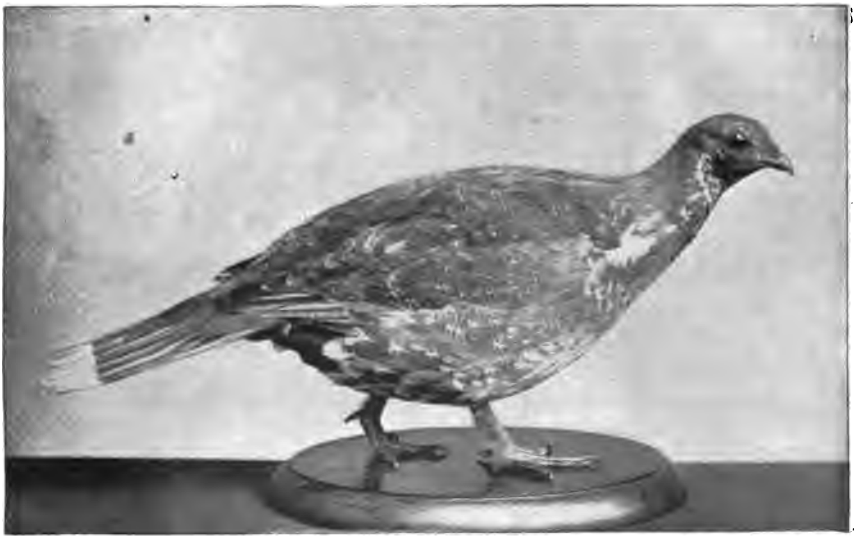
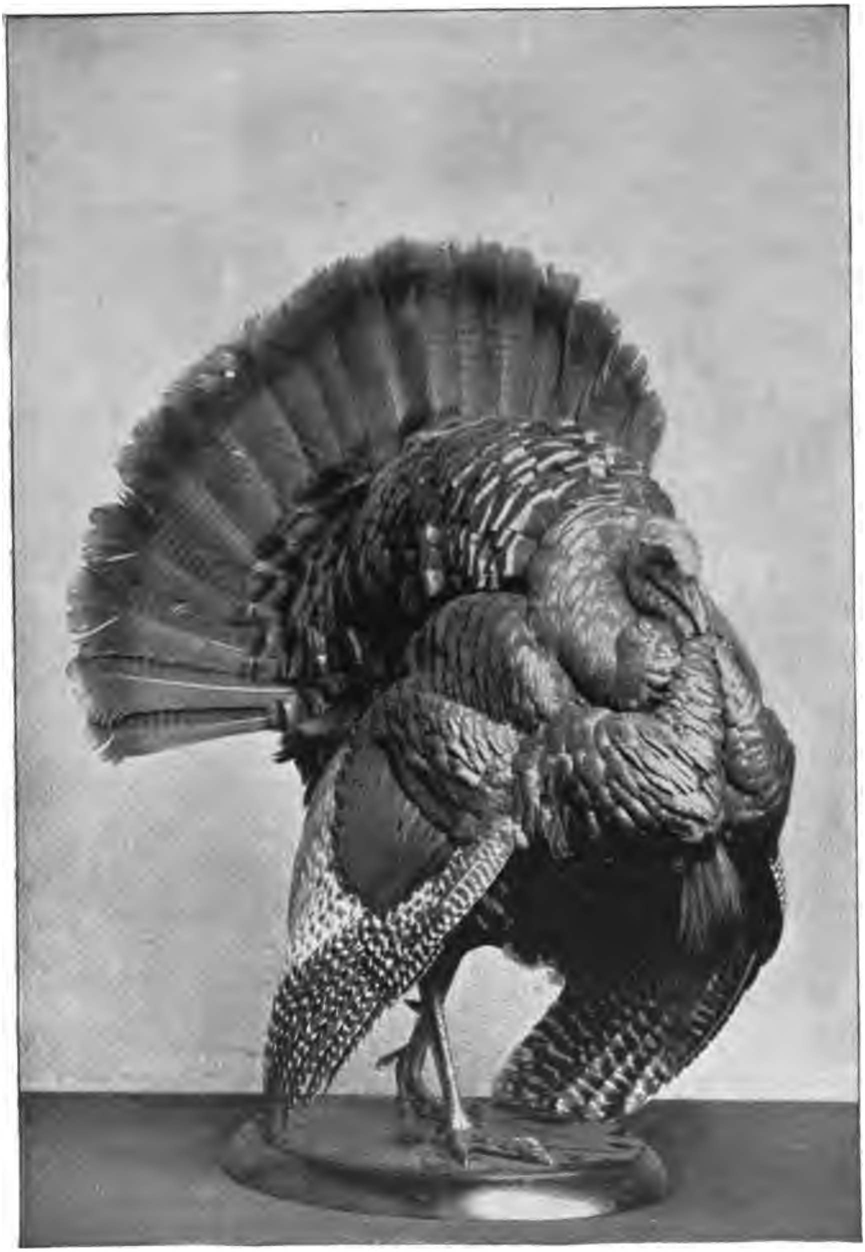
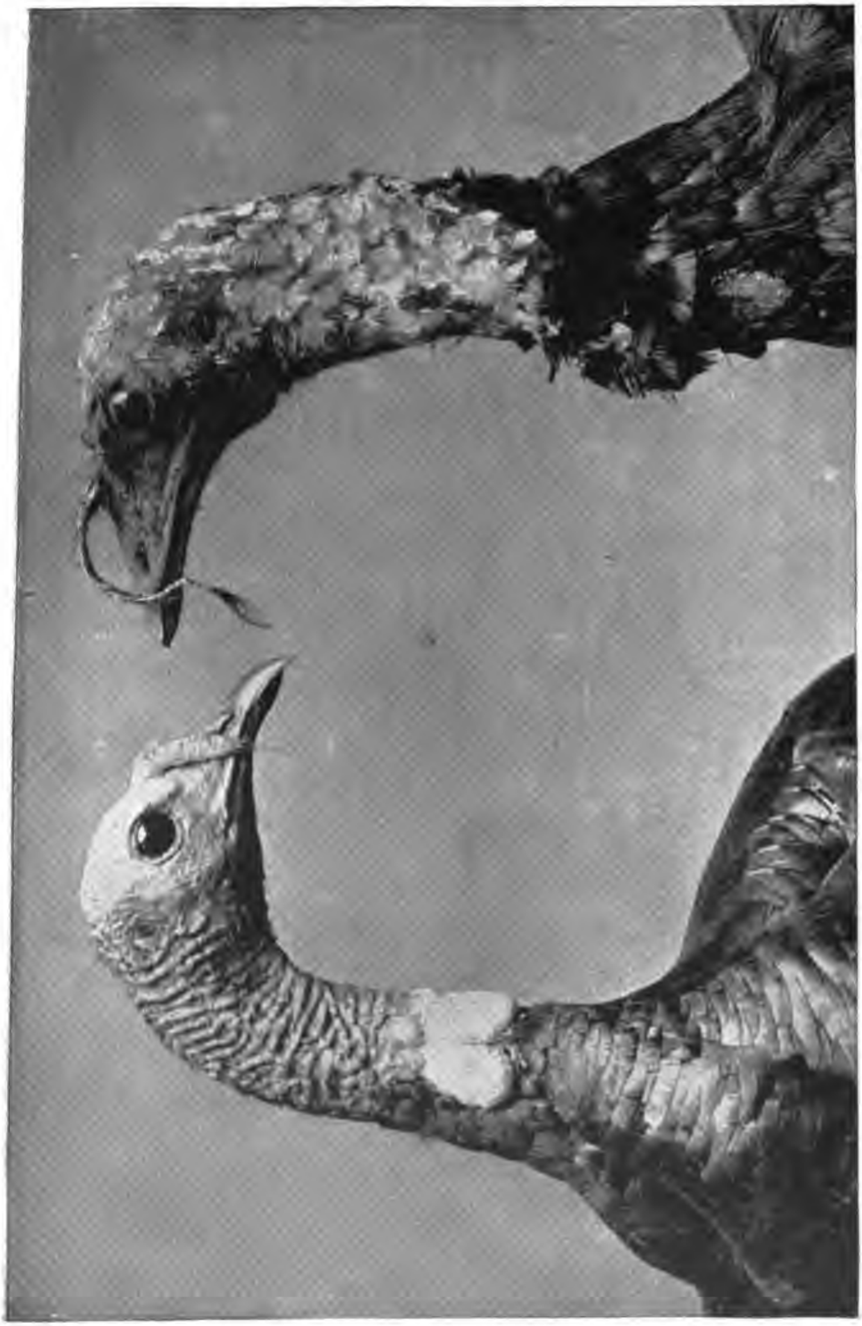


Fig. 2. RICHARDSON'S GROUSE (*Dendragapus canadensis richardsoni*).
Reduced. (Cat. No. 126345, U. S. N. M.)



WILD TURKEY (*Meleagris gallopavo*).
Reduced. (Cat. No. 117389, U. S. N. M.)



HEADS OF WILD TURKEYS (*Meleagris gallopavo*).

Examples of good and bad taxidermy. (Cat. Nos. 126113 and 68420, U. S. N. M.)

is climbing up the trunk of the tree. A fourth specimen, which has been disturbed by another, is pausing to protest with widely opened mouth, while in the act of creeping into the mouth of the burrow.

Please notice the number of facts that are taught by this simple little group. It shows that the opossum is a marsupial, and the female carries her young in a pouch in her own body; that when the young reach a certain age they ride upon the mother's back, clinging to her fur; that the animal is arboreal in habit and has a prehensile tail, by which it is capable of suspending itself; that it burrows in banks in dry situations, and sleeps curled up like a ball in a bed of dry leaves. It also shows the full size of the adult, the young of the previous year, and the recent brood. But for an unfortunate accident, which has yet to be repaired, it would also show the number born at one birth. Of course in this group the grass and moss are properly represented, and there are artificial leaves on the tree branches which enter the group (pp. 240, 241).

Very truly Mr. Hornaday further remarks in the succeeding paragraph:

Groups of this class can easily be made to show the ordinary nesting and breeding habits of the animals represented. Now it happens that animals of some species make a variety of nests, according to circumstances or caprice. In 1889 we prepared a group in three sections, each of which shows one of the habits of the gray squirrel in nesting. Each is composed of an actual nest, and in the identical tree in which it was built by Bunny himself. One represents a nest in a hollow beech tree, in which a pair of gray squirrels bred for years. Another is what might be called a summer nest, made of cedar bark, in the top of a cedar tree. The third section represents an outside nest of green oak leaves, placed on a branch of an oak tree. These three groups are exhibited in one case, but while each is separated from the others by a plate of heavy tinted glass, it is made apparent that they all illustrate the habits of the same animal. The specimens composing the three groups were all collected within a radius of 10 miles of the city of Washington. Besides teaching what the nesting habits of the gray squirrel are, it also impresses upon the observer the very important fact that the habits of different individuals of a given species are capable of wide variation.* They show how dangerous it is for a student or scientific investigator to generalize too freely from one or two facts, and that it is dangerous for anyone to say what an animal will not do (p. 242).

Another scientifically mounted marsupial in the collection is seen in the single specimen of the great Rock Kangaroo (*Macropus robustus*) (Plate LXXIV). This piece of work was done by Mr. Jenness Richardson, then holding the position of taxidermist of the American Museum of Natural Historyof New York City, N. Y., where he produced some avian and mammalian groups quite worthy of his distinguished instructor, the artist from whom I have just been quoting. This large and thoroughly life-like specimen, place din an attitude so natural to it, and with every structural detail so perfectly preserved, is decidedly the best kangaroo in the museum, and being so good, it has the effect of still further depreciating the specimens of bad taxidermy of animals of the same family kept in its proximity in the mammal hall. Some of these are so bad that they have been ordered into the workshops for remodeling. Such a one is shown in Plate LXXV, and it is a very good example of how kangaroos ought *not* to be mounted.

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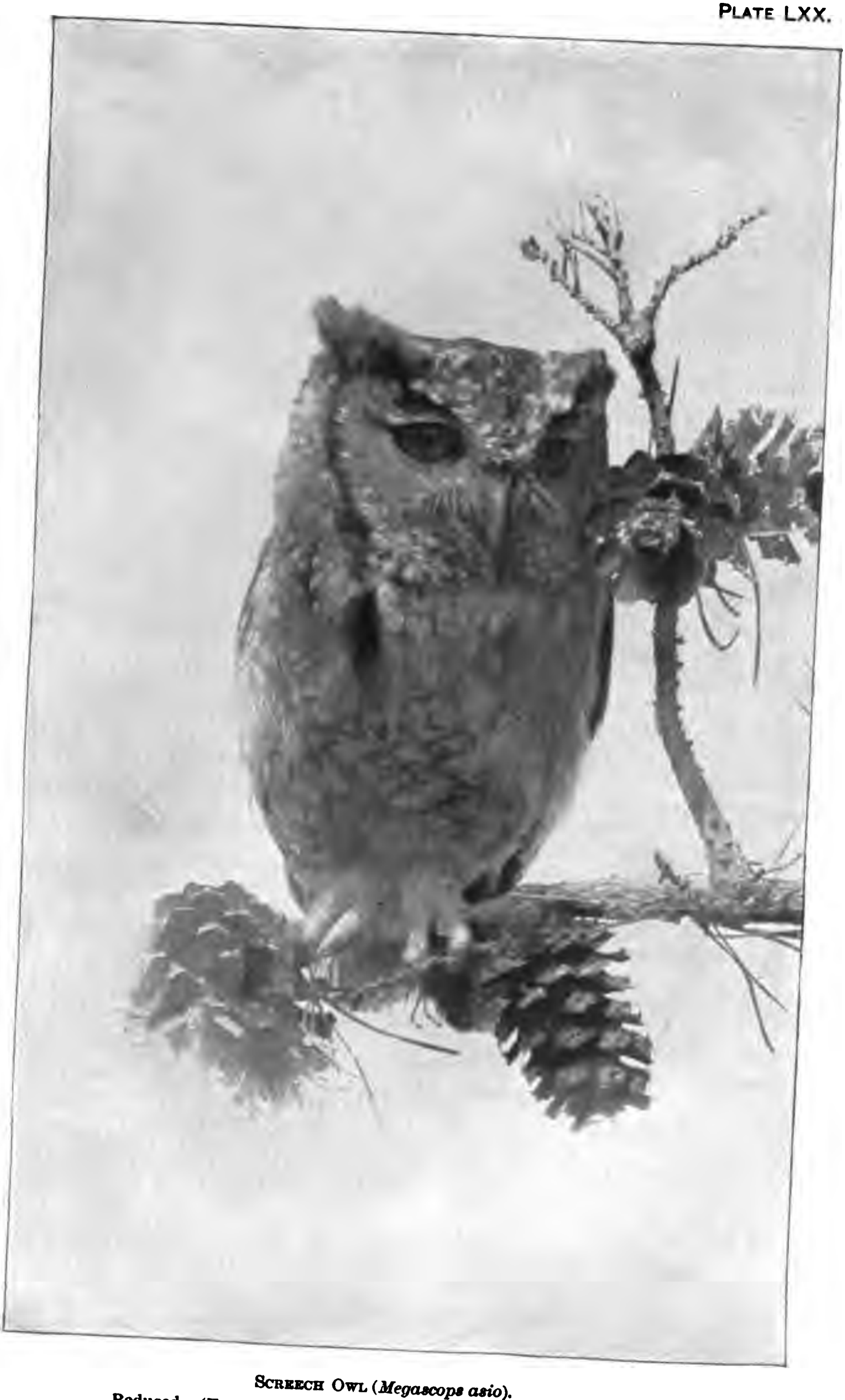
*And what is quite as important, the species, as it occupies a very limited geographical area. Had the place where these squirrels were collected been in an unknown locality, and recently explored, one naturalist might have come away with specimens and one set of notes on breeding habits, and another, and a third, come away with different accounts, none of the three of which would have agreed in this particular.

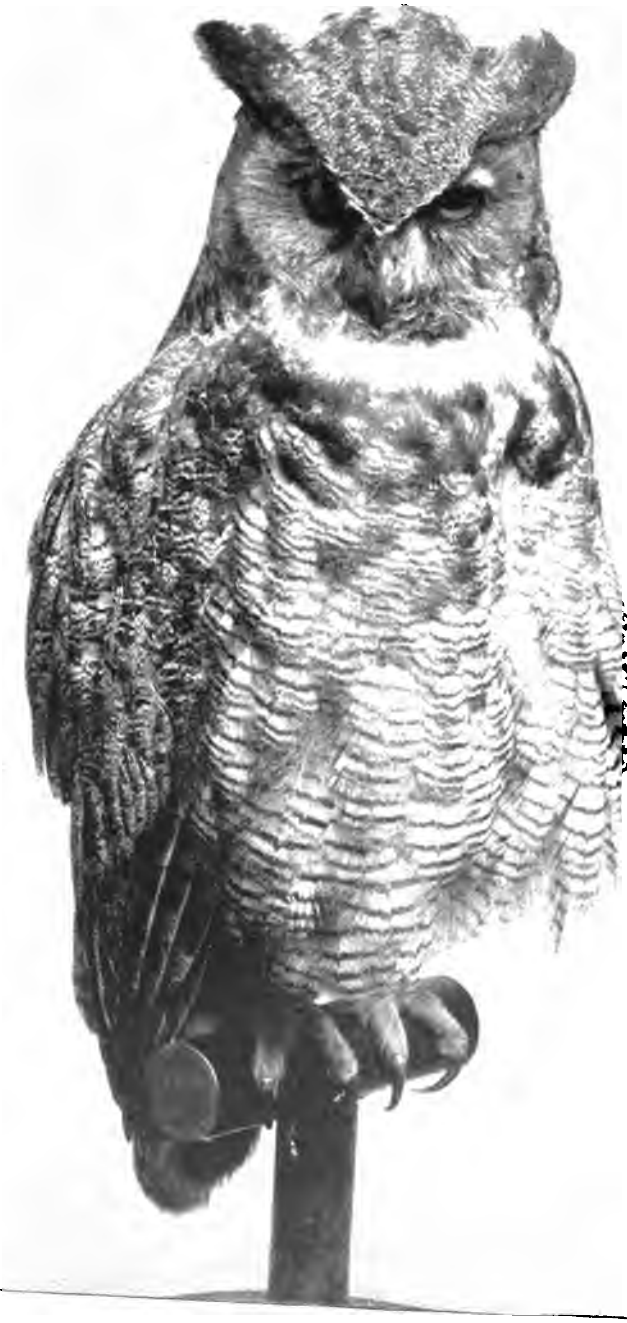
About as near perfect as mammalian groups can be made is another one in the collection seen in the armadilloes (Plate LXXVI). This has three animals preserved in it, all in different positions, while the surroundings, as plants, cacti, etc., are originals that have been collected in the section where these interesting animals are found. So far as its taxidermy is concerned, it may be said that the form of the armadillo is more or less fixed, yet it presents problems to the taxidermist which are quite as difficult to deal with as is the fitting the skin of a hairy mammal to its manakin. If I remember (for the group has at the present writing gone on to the World's Fair at Chicago), some of the accessories in it, as the cacti, are casts, but their reproduction is so perfect, spines and all, that it is simply impossible to distinguish them from the plants as they occur in nature. Speaking of cacti and this group of armadilloes reminds me of a conversation that I had with Mr. William Palmer, who is now doing such admirable work in the taxidermy of mammalian groups at the Museum, in regard to the reproducing in some group a specimen of the giant cactus of our extreme southwestern territorial districts. It may be introduced with great effect in some one of a variety of ways, either in the mammal or the ornithological department, and it is to be hoped that that will be done some time in the near future. Mr. H. W. Henshaw once remarked to me that he found a species of our pigmy owls breeding in holes in the giant cactus, and a group embodying this idea would certainly be one of great value and interest.

A group of mammals requiring an entirely different kind of handling from any we have thus far noticed is seen in the Cetaceans. Papier-maché is here the material to reproduce its various species in the most satisfactory manner, and a very fine example of this is seen in the cast of *Prodelphinus plagiodon* (Cope), shown in Plate LXXVI*a*. Here much depends upon the skill of the colorist, and the smooth surface of the material used offers a beautiful ground to him whereupon to reproduce the exact natural tints of the animal as it is seen in nature. Mr. Shindler, of the Museum, is an adept at much of this, and examples of his skill are best shown in some of the fishes which were noticed upon a preceding page of this report. Incidentally it may be said that to the zoölogist this species of Dolphin is a very interesting one, and its characteristics and relationships have been set forth by Mr. F. W. True in Bulletin No. 36 of the U. S. National Museum publications, entitled "Contributions to the Natural History of the Cetaceans, a Review of the Family Delphinidæ" (p. 66). By all odds the papier-maché cast is the most effective way in which to reproduce the cetaceans for museum exhibitions.

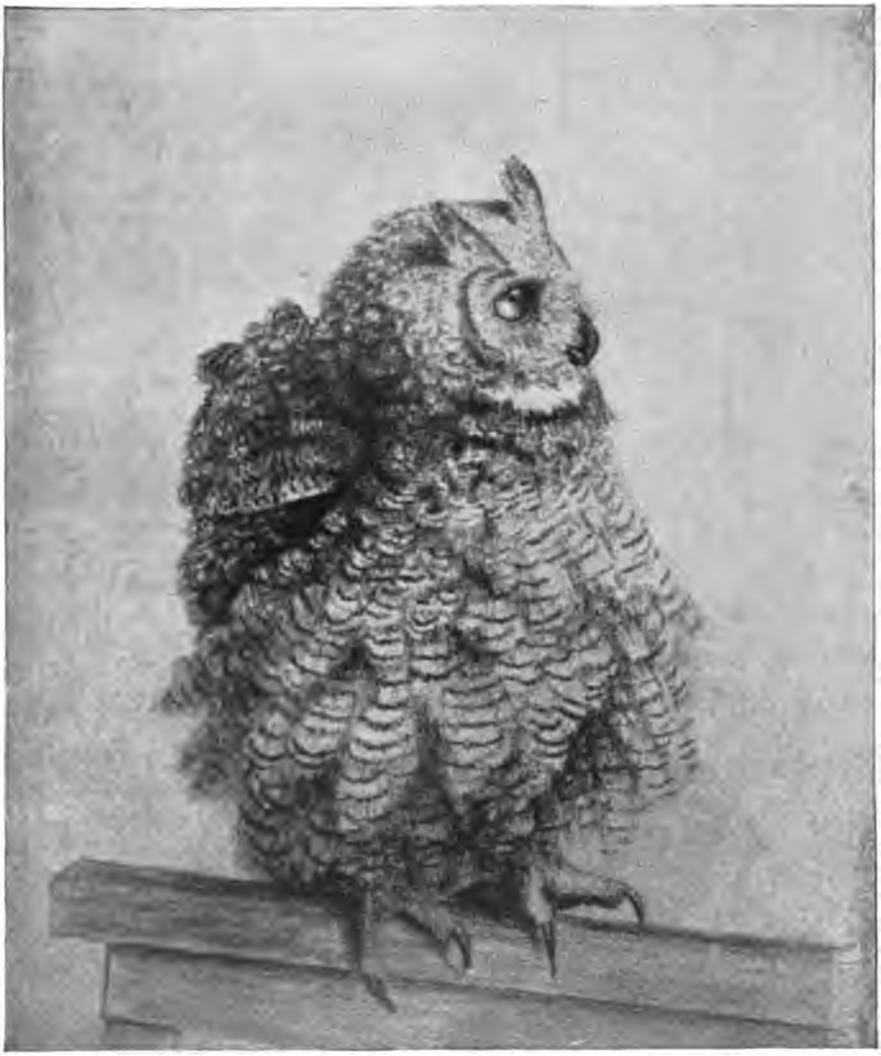
I desire now, at this point, to invite attention to one of the larger



SCREECH OWL (*Megascops asio*).
Reduced. (From a photograph of a living specimen by the author.)

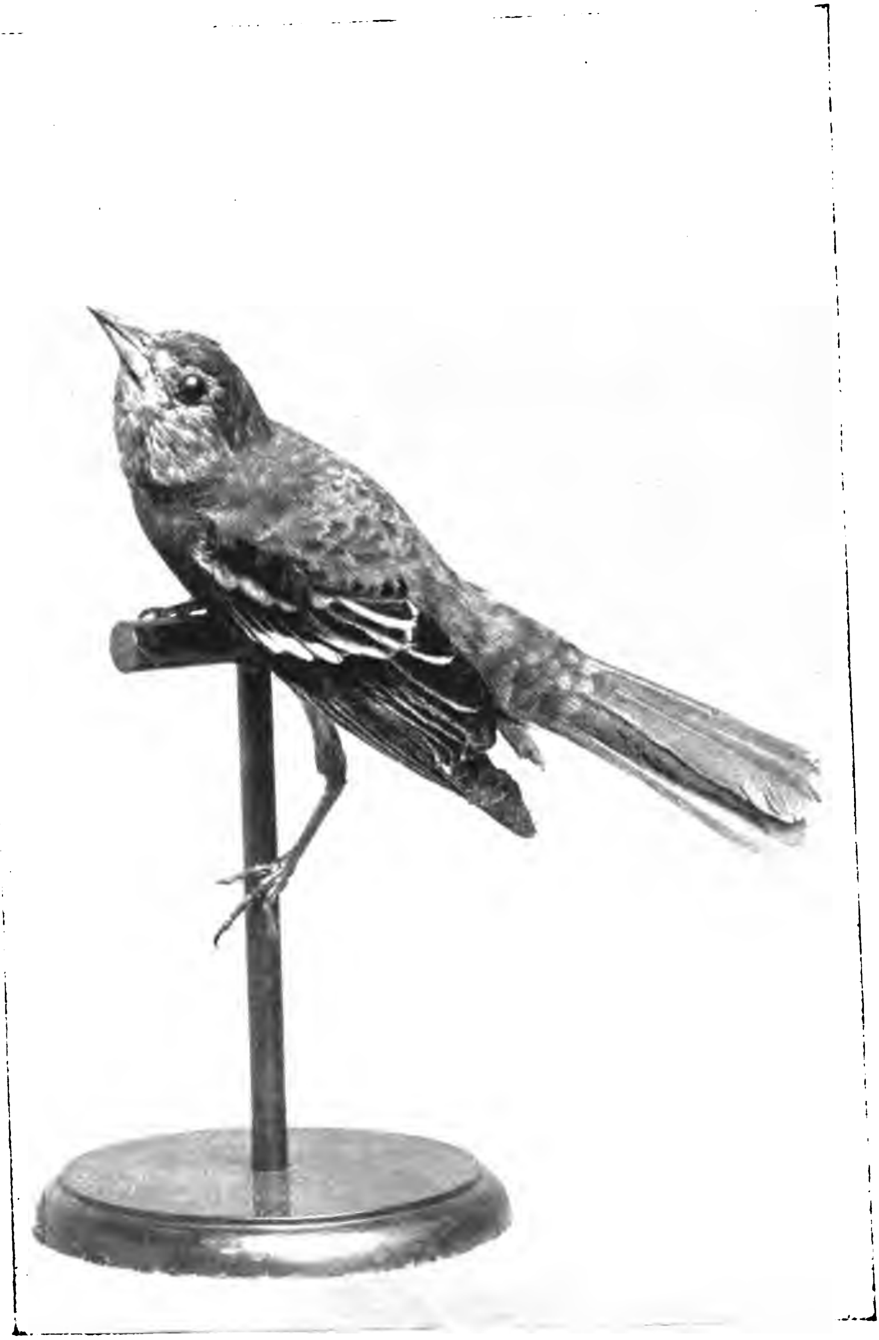


GREAT HORNED OWL (*Bubo virginianus*).
Greatly reduced. (Cat. No. 119367, U. S. N. M.)



Great Horned Owl (*Bubo virginianus*).

Reduced. (Reproduction of a drawing from a photograph of a living specimen.)



BALTIMORE ORIOLE (*Icterus galbula*, ♀).
Somewhat reduced. (Cat. No. 103212, U. S. N. M.)

groups of mammals on exhibition at the Museum, and I will select that magnificent piece of taxidermic work seen in the moose group. A number of these massive cervidine animals have actually been mounted with the most perfect surroundings of their natural habitat in one great interesting collection, all under a single glass case. They are, probably without exception, altogether the finest series of mounted moose in this or any other country.

The act of the young buck riding down a sapling has been questioned by some, but I believe that the practice of the animal to accomplish that feat in order to reach the delicate foliage of the tree can be well substantiated.

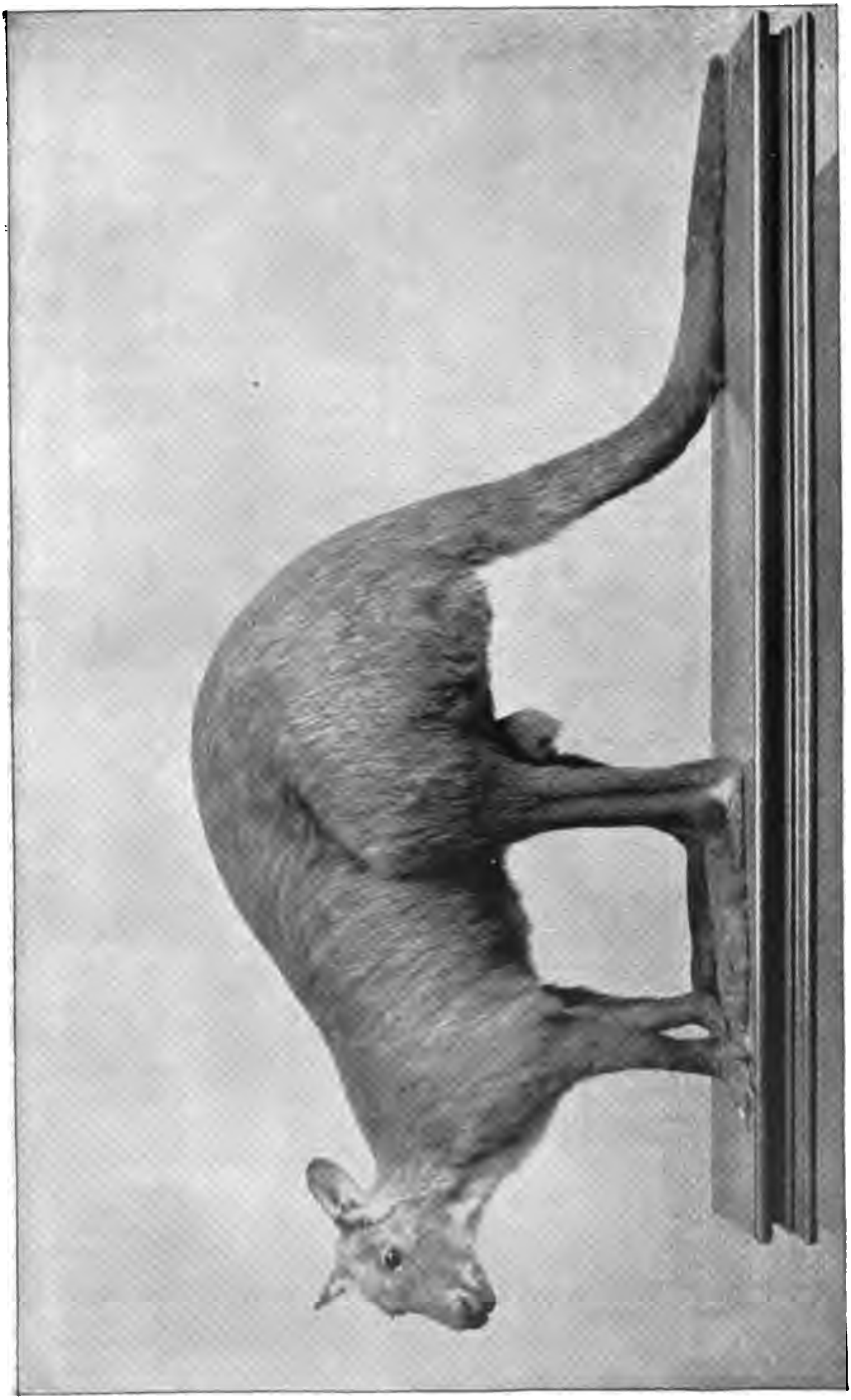
Hornaday has said of this piece in his Taxidermy (pp. 246, 247):

> The setting represents a section of the moose woods of upper Canada, in which the larger animals are browsing on the tender twigs of the white birch. The animals have come together at the edge of a bog, which is growing full of a gigantic species of grayish moss peculiar to that locality. The time represented is the middle of autumn. The few leaves that remain on the maple saplings have been painted with October's most gorgeous tints of crimson and yellow, mixed with green, and the leaves of the white birch have turned pale yellow. The ground is plentifully strewn with leaves of bright tints, through which the green moss of moist banks shows in patches here and there.
>
> Of the animals, the three largest—and huge beasts they are, truly—are feeding upon the birch twigs. A yearling calf is licking the head of a tiny brown-coated younger brother, while a two-year-old bull is in the act of "riding down" a stout birch sapling in order to get at the branches of its top, which would otherwise be beyond his reach.

Three of these fine specimens were collected by Col. Cecil Clay, of Washington, and by him presented to the Museum for this group, together with the trees, moss, and other accessories, which he collected with infinite labor and care in the moose woods. He also furnished us with field notes and critical advice throughout, which had much to do in making the group what it is—a monument to Col. Clay's skill and prowess as a sportsman, and to his deep interest in *Alces malchis*. It is to be sincerely hoped that other sportsmen will follow the colonel's admirable example, and aid the museums in which they are most interested to secure some attractive groups. There can be no doubt whatever as to the perfectness in which these animals are mounted and preserved, and they are apparently in their external forms very true to nature. While we have the taxidermy of the Cervidæ under consideration, however, it would appear to be as well to refer to one great common defect that we have frequently observed made by taxidermists in them, and that is the lack of care that is sometimes evident in the proper handling of the lacrymal depression in these animals, or in other words, the pit which occurs in so many of them just anterior to the distal canthus of the eye. I have seen plenty of deer heads which, from an artistic standpoint were otherwise very creditable pieces of work, but in which this fossa had been almost or quite obliterated. It is to the strict attention to such anatomical details that very often the success and reputation of a taxidermist depends, and he can do no better than to see well to it that no such flaws creep into his performances.

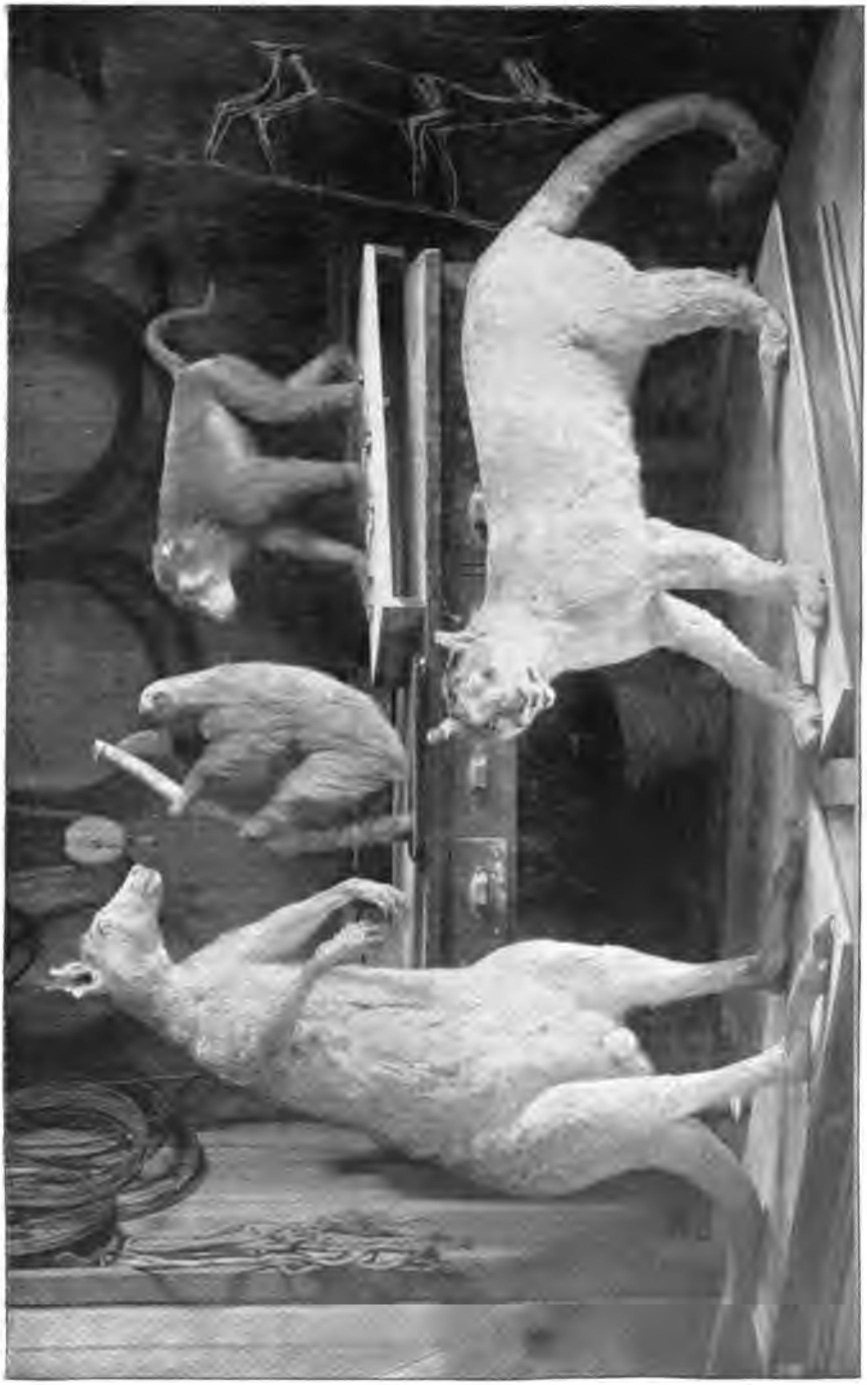
This group of moose is about the only notable thing of the kind that the National Museum has for the Cervidæ at present, but this does not mean to imply that a general poverty exists in so far as that family is concerned. There are a goodly number of individual pieces of deer, some of which, however, are deplorable-looking objects, and fitting relics of those days when taxidermy had not reached to what it can do so well in these times. Among the better specimens we observe a fine piece in that representative of the antelope group known as Thomson's Gazelle (*Gazella thomsonii*), Plate LXXVIII. It has been entered as No. 18964 of the collection of the Museum, and has been recently described by Mr. True in his "An Annotated Catalogue of the Animals Collected by Dr. W. L. Abbott in the Kilima-Njaro Region, East Africa." (Proc. U. S. Nat. Mus. v, XV, p. 473., Pl. LXXVII, 1892). The faults in the mounting of this specimen are of so trivial a nature that it is not worth my while to enumerate them here, and were all the deer and their kin preserved as well as this specimen is, it would be far more of a pleasure to the sensitive naturalist to gaze upon them, who is now pardonably often shocked upon viewing some of his favorites in the museum cases.

But to return to the groups, we have now to notice perhaps one of the very finest accomplishments that the art of taxidermy has produced in this country. I refer to the case containing the several specimens of our now nearly extinct bison or American buffalo. This triumph in the preservation of mammals of ponderous proportions is almost entirely due to the consummate skill and perseverance of Hornaday, who has popularly described it in many places. This latter fact, taken in connection with the fine Plate (LXXIX) I have been permitted to give of it, renders it obviously unnecessary for me to dwell upon the general appearance of this life-like herd of bovines. They are all true to the life, preserved by all the most efficient methods of modern taxidermy, and, what is not generally known by people who are, or have been, privileged to see this case, that the very sod upon which these animals now stand was brought for the purpose all the way from Montana, being shipped direct from the buffalo ranges of that territory to Washington. This applies also to the sage-brush which is made to appear to be actually growing therein; and the broom-sedge, and the cacti. The skulls and other bones of the buffalo lying about were gathered in the same place; indeed, as a whole, it is a strip of a Montana prairie of an old range of these animals, picked up piecemeal, and now again unfolded in the case at the Museum just as it occurred in nature. Even the very buffalo tracks seen about the pool of water in the case were made by using a real buffalo's hoof for the stamp to make the impressions. No

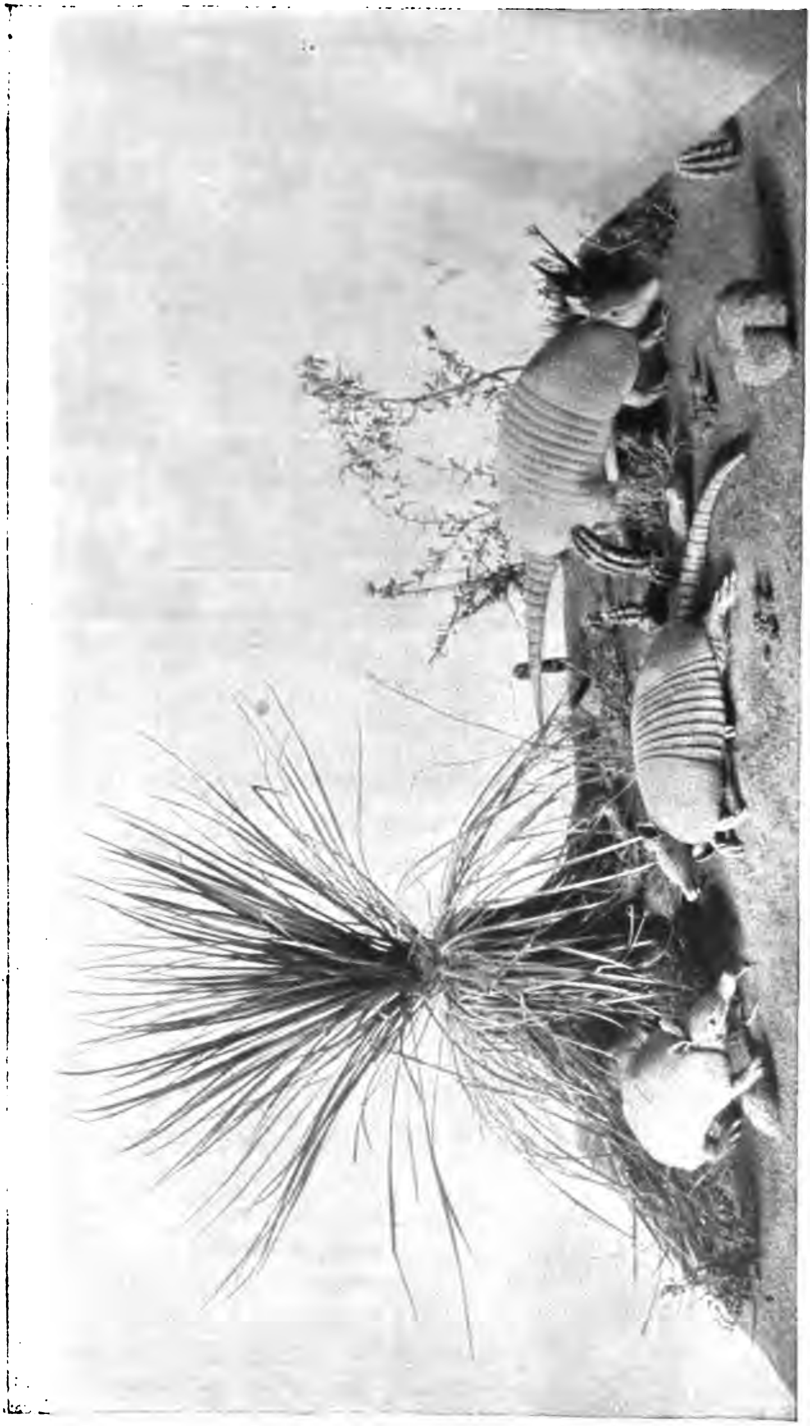


GREAT ROCK KANGAROO (*Macropus robustus*, ♂).

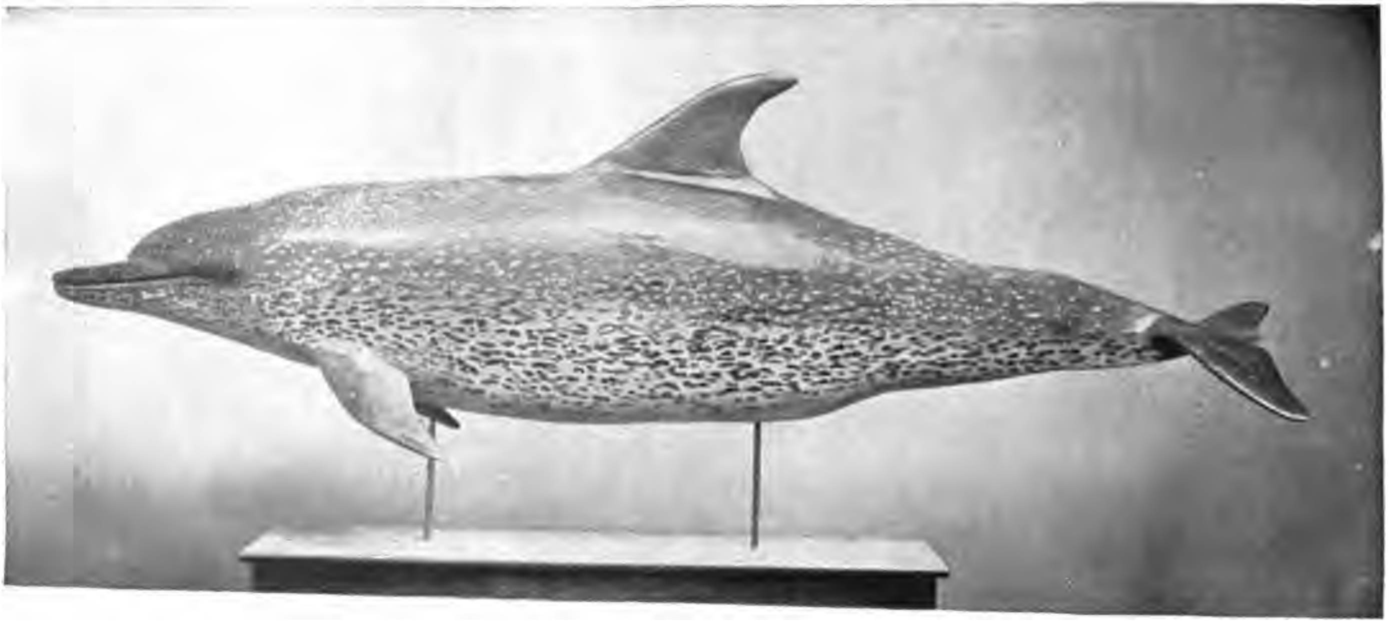
PLATE LXXV.



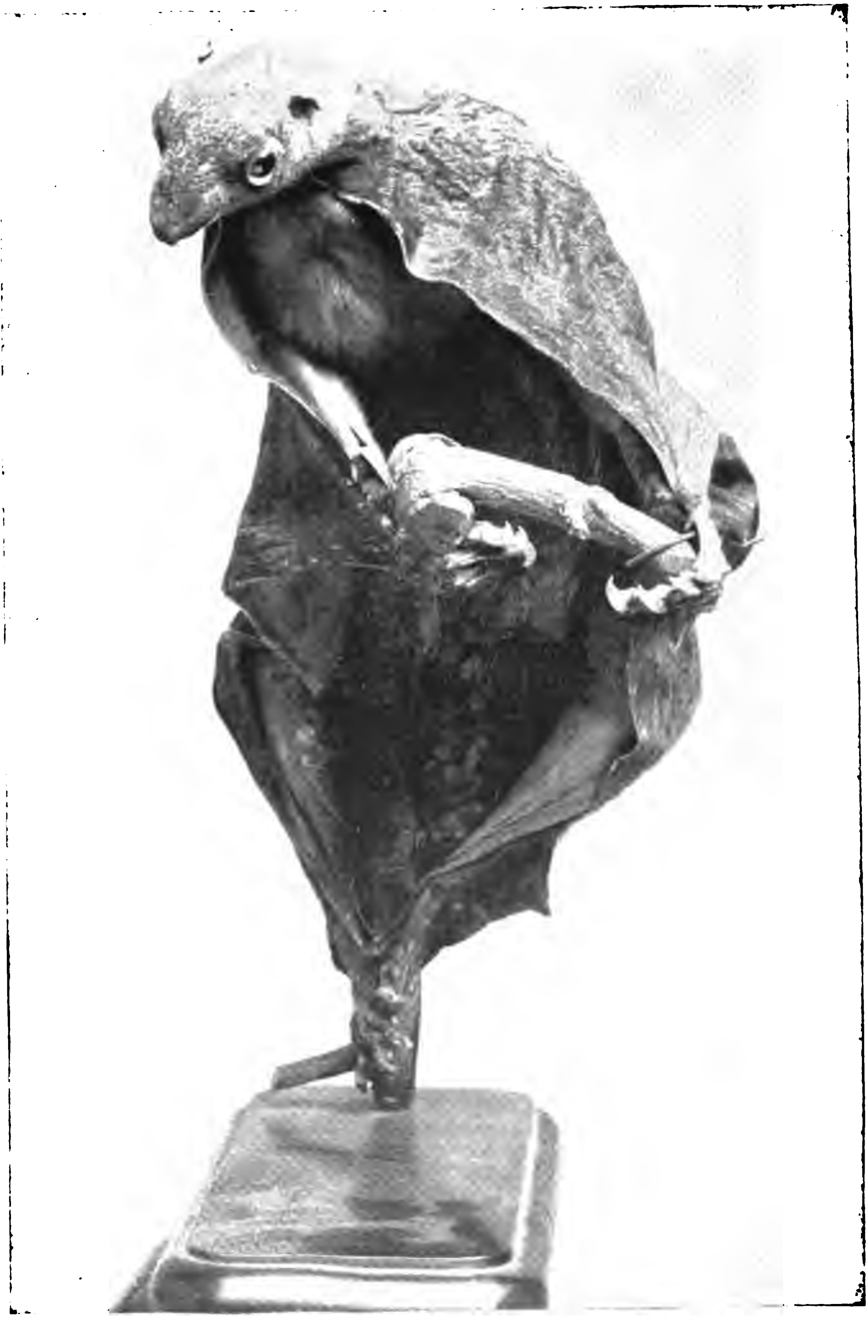
Defective Specimens, including a Badly Mounted Kangaroo.



Group of Armadillos (*Tatusia novem-cincta*).



SPOTTED PORPOISE (*Prodelphinus plagiodon*).
From a papier-maché cast; greatly reduced. (Cat. No. 22017, U. S. N. M.)



FLYING LEMUR, OR COLUGO (*Galeopithecus volans*).
An example of bad taxidermy. (Cat. No. 3946, U. S. N. M.)

art known to me has ever accomplished a grander feat than this, and it is as fully worthy of our unstinted admiration as is any form that has ever materialized beneath the chisel of an Angelo or a Hiram Powers. And were I to choose between being the author of Paul Potter's bull and these buffalo, I should without a moment's hesitation decide in favor of the latter.

They will be standing in as good order as they are at this writing, long after the former has faded away from off its canvas.

Many fine groups of mammals were by the National Museum sent on to the World's Columbian Exposition at Chicago to form a part of the Smithsonian exhibit. Most of these were as fine things of the kind as have ever been seen in this country, and the writer of this report enjoyed the unusual privilege of seeing many of these in the course of their mounting. This was accomplished by a corps of skillful workmen, including such men as Mr. Joseph Palmer, William Palmer, George Marshall, and others, the whole being under the direction of Mr. F. W. True, curator of mammals.

It would be quite out of the question to even enumerate, not to say describe, all of the groups or single pieces of mammals that now enrich the collections of the U. S. National Museum. We can at the best put in a word here and there about the most notable of them and the good or bad points they offer us. Among those as yet unnoticed is the fine case containing the three specimens of *Ovibos moschatus*, the musk oxen, and I have heard various criticisms in regard to the forms that were bestowed upon those animals by the taxidermist who preserved them. Never having seen the animal alive, I hardly feel competent to judge in the matter, but that the group is a most pleasing one there can be no question. They are represented standing upon barren rock which has recently been overlain by a light fall of snow. This last has been admirably rendered by a composition compounded of starch, the pulp of white blotting paper, and plaster-of-Paris—an invention of Mr. Joseph Palmer's that has produced a very realistic effect.

Perhaps the best mounted specimen of a Musk Ox now extant is the one in the possession of E. V. Skinner, esq., of the Canadian Pacific Railroad Company, and valued at $2,500.

Mr. Frederic S. Webster published an account of this animal in Forest and Stream, of New York, in its issue of January 26, 1893, and gave a figure of the Ox. Through the kindness of Mr. Skinner for the waiving of copyright and loan of the electro of that figure we are enabled to reproduce it here in Plate LXXX. Mr. Webster's article in Forest and Stream was entitled "An Arctic Rover," and ran as follows:

The musk ox (*Ovibos moschatus*) is considered by naturalists one of the rarest of our North American mammalia. In a clime of almost perpetual winter, within the Arctic Circle, this animal lives and thrives. In a land which has been so fascinating and so fatal to the many explorers who have sought to solve the mysteries of these desolate rocky ice-bound fields, in which no animal, it would seem, could exist, the hardy musk ox roams at will during the entire year. The ability to stand the rigors of such a climate is a striking feature of its interesting life history.

The musk ox is at present found only in the most northern parts of North America, where it ranges in small bands on the barren grounds between the sixtieth parallel and the shores of the Arctic Sea. Its southern range is gradually contracting, and it is no longer met with west of the Mackenzie River. It is found through the Parry Islands and Grinnell Land to North Greenland, reaching on the west coast as far south as Mellvile Bay. It was met with by all the polar exploring expeditions, including the De Long, Hall, and Greely parties. Lieut. R. E. Peary in his late Greenland journey secured several specimens of various ages, and reports it comparatively abundant. The German polar expedition of 1869–'70 found it at Sabine Island on the east coast. In former times the musk ox roamed in other parts of the world. Its fossil remains, or those of an allied species, have been found in northern Siberia and the plains of Germany and France. It has also been found in the gravel beds in several parts of England, as Bromley, Bath, and Freshfield, and also in the brick earth of the Thames Valley at Crayford, Kent.

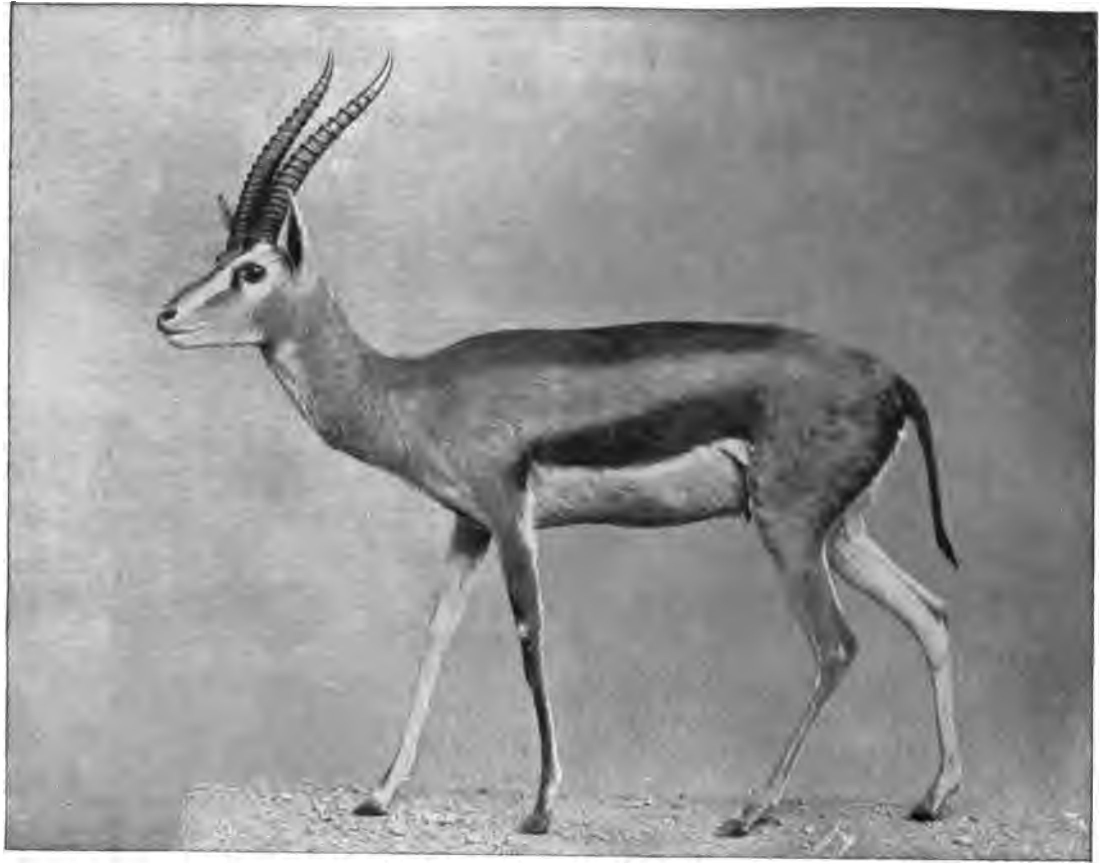
In size the musk ox equals the smaller varieties of Scotch and Welsh cattle, but in structure and habits it is more like the sheep; and the combination of characteristics is well expressed by its generic name, *Ovibos.* It is gregarious in habit, going in herds of 20 or 30 head, and sometimes 90 or 100 have been observed. The bands contain one or two full-grown bulls. Notwithstanding their short legs, they run with considerable speed. When frightened, they gather together like a flock of sheep, and follow a leader as sheep do an old ram. This habit makes the total extermination of a herd an easy task, when it is the desire of its destroyers to accomplish it. When thoroughly alarmed they easily ascend precipitous slopes, their curved, sharp-edged hoofs greatly aiding them in gaining a foothold.

The name of musk ox is given on account of the musky odor exhaled by the animal. The odor does not proceed from any special gland, as in the case of the musk deer and other animals which secrete a musky odor. The cause of this peculiar odor has not been satisfactorily explained.

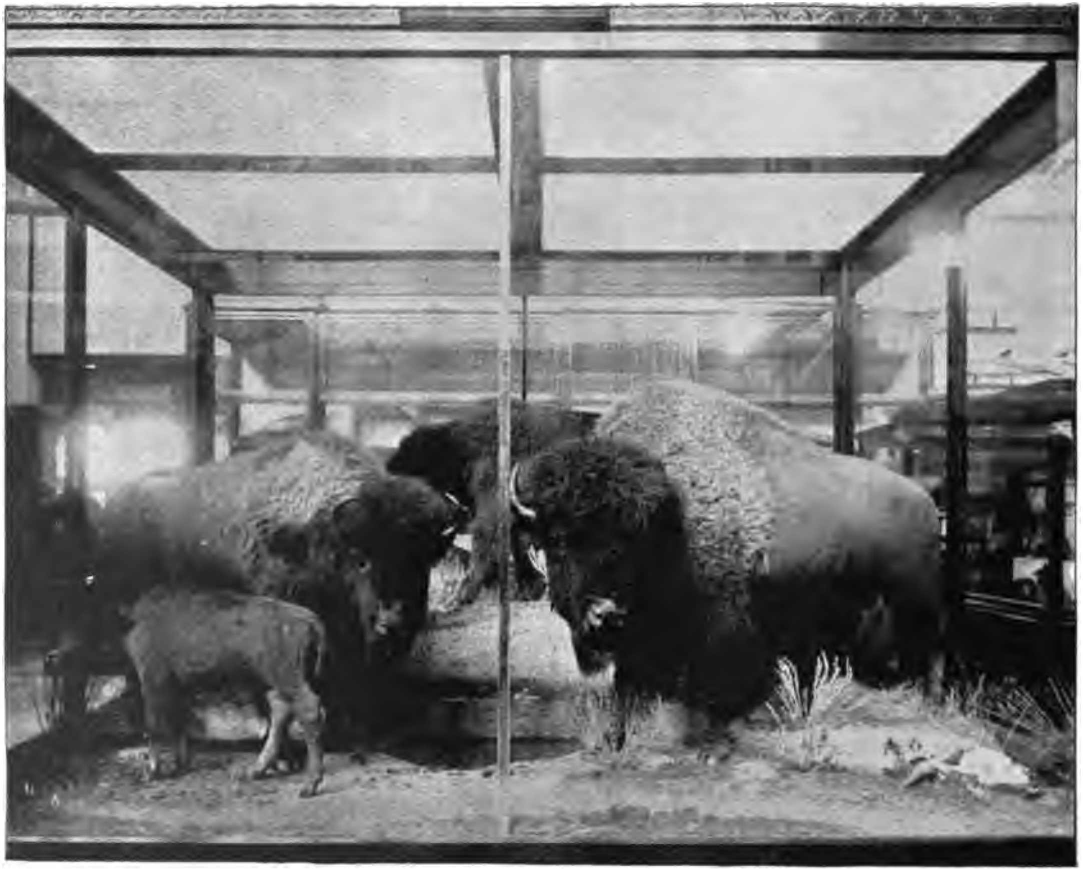
According to Sir John Richardson, "when the animal is fat its flesh is well tasted and resembles that of caribou, but has a coarser grain." According to other authorities the flesh of the bulls is highly flavored, and both bulls and cows, when lean, smell strongly of musk. This odor does not seem to be confined to either sex, or to any particular season of the year. At times the flesh of some of the animals is said to be tender and very well flavored.

The carcass of a good-sized male will weigh 300 to 350 pounds. In summer they accumulate considerable fat, and during winter use up this fatty tissue. The males are considerably larger than the females. The cows calve about June 1, giving birth to one young one. The animal is also known as musk buffalo and musk sheep, both very expressive names.

The animal has a very prominent tendency to a hump. The dorsal processes of the vertebral column, as shown in the skeleton, indicate this. The dense, long, and somewhat stiff bunch of hair over the shoulders plainly proves that the animal possesses a hump. All specimens which have been heretofore mounted do not show this feature of the animal. The head is large and broad. The horns in the old males are extremely broad at the base, meeting in the median line and covering the whole top of the head. They are directed, at first, slightly outward, and then suddenly downward by the side of the head, and then they turn upward with a graceful curve, and forward, ending in the same plane as the eye. The horns at the base are rough, but gradually grow smooth from the center to the tips, which are round, glossy, and black. At the base they are a dull white. The horns of the females are much smaller, and at their base the space between them is much broader in the middle of the forehead. The ears are small and are concealed in the hair. The space between the nostrils and the upper lip is covered with a short, close hair, as in goats and



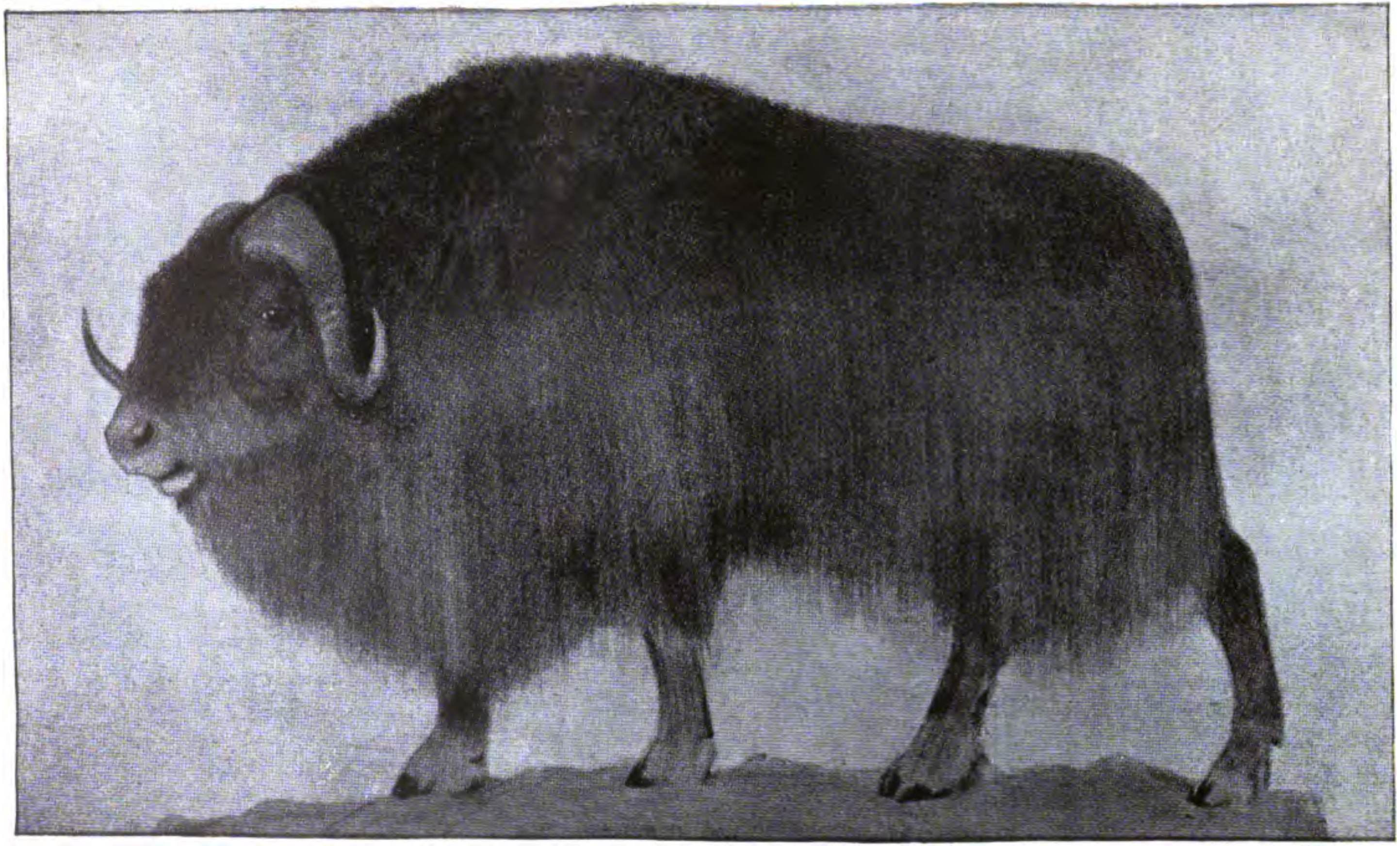
THOMSON'S GAZELLE (*Gazella thomsonii*, Günther).
(Cat. No. 18964, U. S. N. M.)



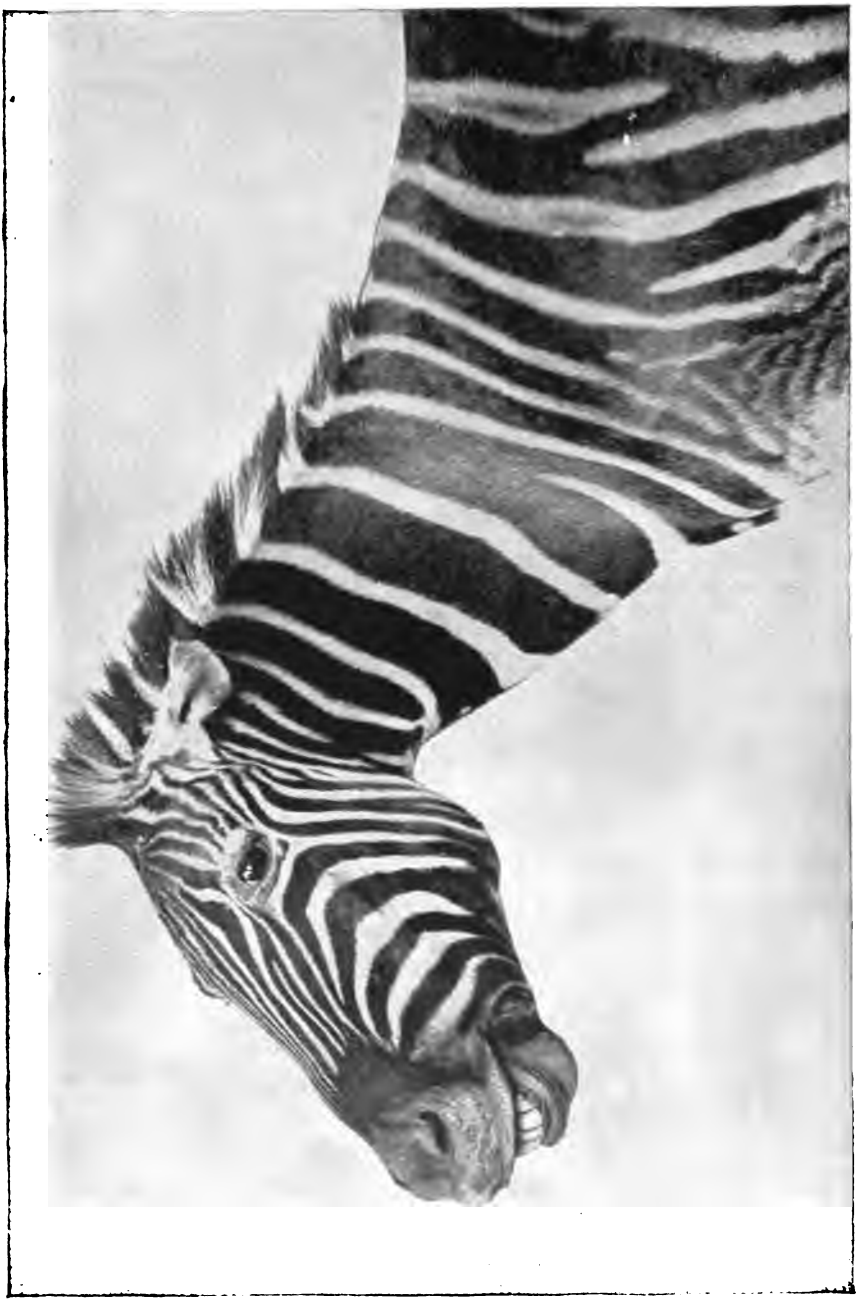
GROUP OF AMERICAN BISON (*Bison americanus*).

(Cat. Nos. 15697, 15703, 15503, 15685, 15686, 15694, U. S. N. M.)

PLATE LXXX.



Musk Ox (*Ovibos moschatus*).
(Published by permission of E. V. Skinner, esq., of the Canadian Pacific Railroad Company.)



HEAD OF ZEBRA (*Equus burchellii*).
(Cat. No. 15120, U. S. N. M.)

sheep, and has no trace of the bare "muffle" of oxen. The general color of the hair is a rich brown, shading into black. It is long, matted, and rather curly at the neck and shoulders. On the back and hips the hair is long and straight, on the sides of the body exceedingly long, so long as to hang below the middle of the legs. In some specimens which we have measured the longest hairs have been 20 inches long. In the center of the back there is a patch of soiled brownish white, termed the saddle.

There is a closely-matted short under wool, exceedingly soft and fine of texture, and so dense that it is impervious to snow and rain. On the chest the hair is long and straight, and hangs down gracefully like fringe. The tail is short and hidden in the long hair on the hips. On the legs the hair is short, stiff, and without any underwool. The hoofs are much curved and larger than those of the caribou, which they resemble in shape, and the eye of a skilled hunter would be taxed to detect the difference between the tracks of the two species in the snow. The bones of the animal are very dense; those of the legs have the weight and appearance of ivory.

The food of the musk ox is similar to that of the caribou, and consists of grass at one season and lichen at another. The curved hoofs enable the animal to scrape away the deep snows which cover their scanty food. Their sense of smell is very acute. The illustration of the musk ox here given represents the character of the animal. The specimen from which it is taken is the largest in this country or Europe. The skin of this specimen was obtained by E. V. Skinner, esq., of the Canadian Pacific Railroad, and placed in the hands of Messrs. Sowdon and Webster, of 14 East Forty-second street, this city, who have prepared it, as faithfully represented by the plate. Through the kindness and by the permission of Mr. Skinner we have the pleasure of placing before our readers this handsome likeness.

This specimen was sledded by natives over 1,400 miles near Fort Franklin, and was received here in fine condition. The order for it was given three years since and the specimen has been in transit most of this time. The few measurements may serve to impress the reader with the proportions of this particular specimen. The animal stands at the shoulder 4 feet 5 inches; the length from nose to stern is 6 feet 7 inches; height at the rump, 3 feet 10 inches; length of head from base of skull to end of nose, 24 inches; length of horn from median line, following the outside curve to tip, 24 inches; width of both horns at base, 12 inches; diameter of horns at base, 9¼ inches; breadth of muzzle, 4¾ inches; circumference of muzzle, 14 inches; circumference of hoof of front leg, 17 inches; circumference of hoof of hind leg, 13 inches.

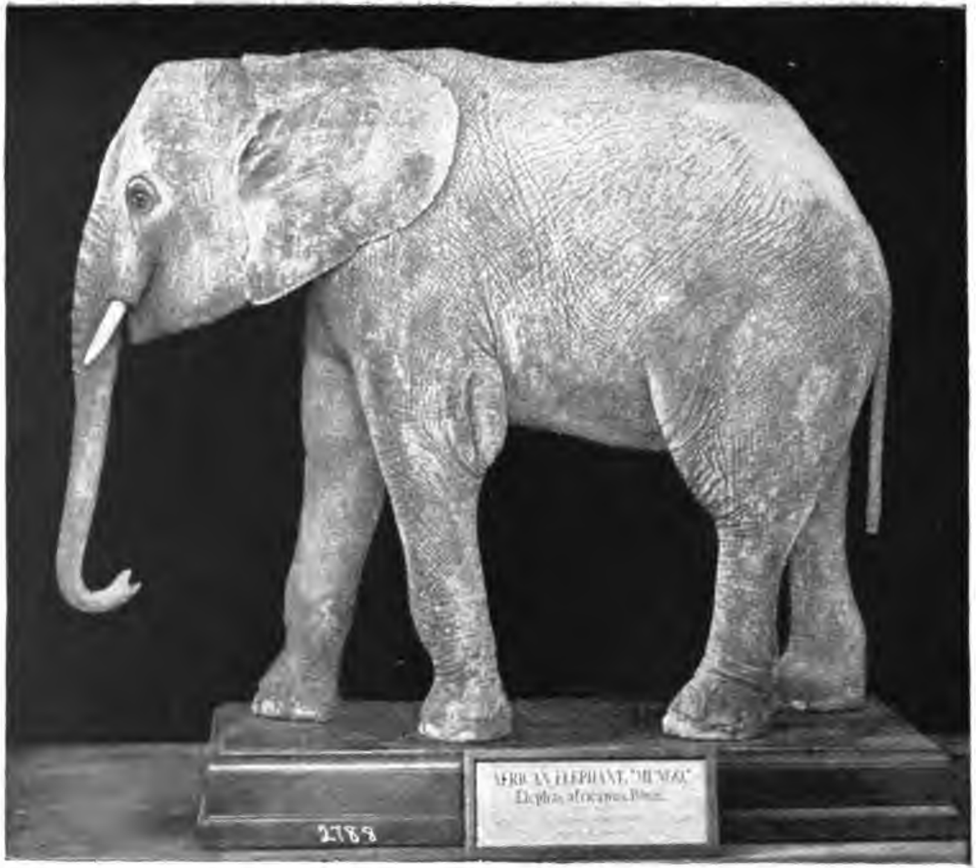
There are but four other mounted specimens of the musk ox in this country. One is at Harvard College, Cambridge, Mass., and three compose a group at the U. S. National Museum, Washington, D. C. Of these, one is a male, one a female, and one a two-year-old, none of them superior specimens.

Among the mounted species of the *Equidæ* at the National Museum none can, in my estimation, in any way approach the specimen of Burchell's zebra (Plate LXXXI). The animal has been given an attitude indicative of moderate movement, with the evident idea in its mind of making an attack or standing at bay, in which he will use his teeth to bite—a habit so familiar to us in some cases of vicious horses. The short mane is semierect, the ears are thrown back, the eye looks the owner's intent, while the quivering and nearly rigid lips drawn apart show the glistening upper "nippers" and the crowns of the lower ones; the nostrils are somewhat closed by the elevation of the superior lip; finally, the entire rendering of the whole animal is most perfect in all particulars. I am enabled to present herewith the left lateral view of the head of this zebra, so its excellence may be the better appreciated.

But the climax of the taxidermist's ambition is reached when he can mount a hairless mammal, large or small, that is at once a perfect reproduction of the original, and will keep indefinitely uninjured by the ordinary ravages of time and pests. Of this kind of work the Museum has several notable examples, and none of these can exceed in beauty of design, and consummate skill and knowledge in workmanship the now famous African elephant "Mungo" (Plate LXXXII). Chief among the factors of success in mounting an animal of this kind is the fact that the skin is laid over a thick coat of clay, which latter overspreads the manikin. Through this ingenious device, after the skin is on and the taxidermist essays to model the form to copy the live animal in every particular, it is seen that all the depressions, wrinkles, lines, and pits, and protuberances can be exactly reproduced by the proper simple instruments by working them on the skin through the agency of the yielding clay beneath it. I have compared most critically this specimen "Mungo" with photographs of living elephants in my collection, and find that in each and every particular it is anatomically correct, and that the attitude is most perfect. Another piece which shows equally well the master hand is the specimen of the hairless Mexican terrier (Plate XC). This dog had no hair at all apparently, and his skin was as thin as ordinary writing paper, but through the aid of a plaster cast of his entire body as a model and the use of the clay-covered manikin, a most remarkably fine thing has been produced. This specimen has also been delicately tinted where it became necessary, and as now preserved will last without change for an indefinite length of years. Hornaday mounted both "Mungo" and this terrier. The first received the silver specialty medal awarded "for the best piece in entire exhibition" at the New York exhibition of the Society of American Taxidermists in 1883, which prize was nearly wrested from it by the judges and given to the terrier, which had been entered in competition against it. This process of using clay has also been employed by its introducer in mounting the bison, polar bear, Burchell's zebra, the tiger, and the puma, figures of each of which illustrate this paper and are the work of the same illustrious taxidermist.

Speaking of comparing "Mungo" with photographs of living elephants brings up the use of the camera again as applied to mammals. Now, I entirely dissent from Mr. Hornaday's opinion as to the necessity of taking photographs of all the mammals we can. I believe in photographing them in all positions, every possible species, wild and domesticated, living and dead. In his Taxidermy (pp. 21, 22) he remarks:

> To the taxidermist and collector, photographs of dead animals are of very little value, unless it be a large picture of the head of a large specimen, such as a moose, but that photographs of live animals, taken "broadside on," as the sailors say, are extremely valuable aids in mounting; but these you get only in the zoölogical gardens. I never took a camera into the field with me, and have always been glad of it, for it would not have repaid the trouble it would have involved.



AFRICAN ELEPHANT "MUNGO" (*Elephas africanus*, juv.).
(Cat. No. 13418, U. S. N. M.)

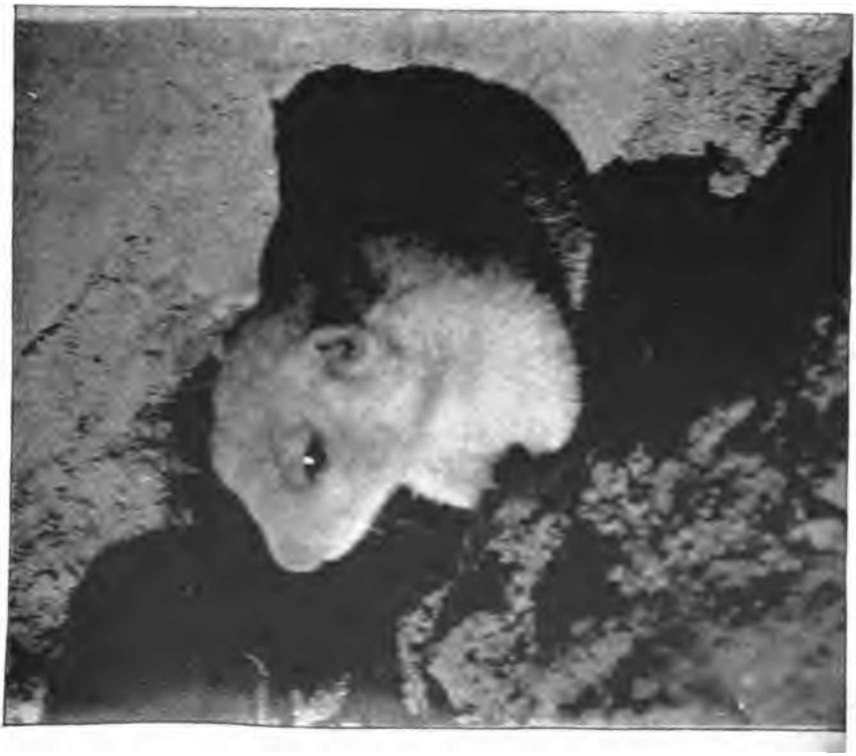


Fig. 1. WESTERN "PRAIRIE DOG" (*Cynomys columbianus*, ♂).

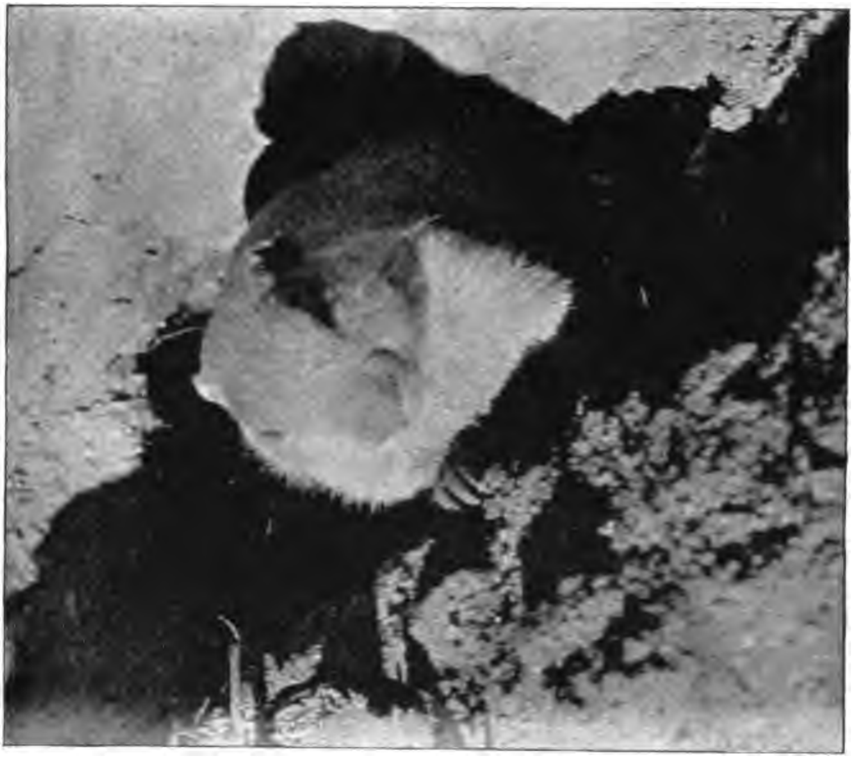
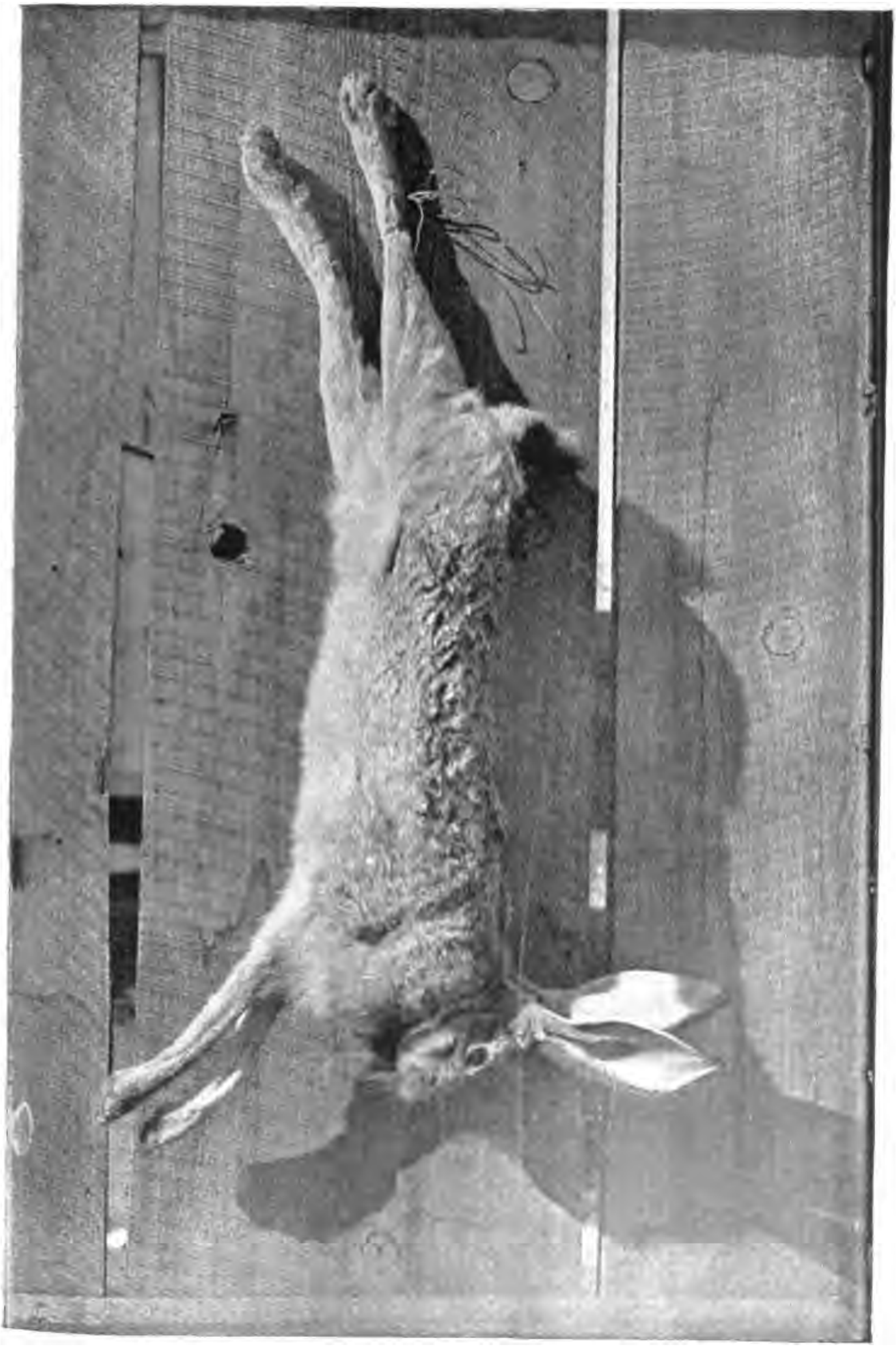


Fig. 2. WESTERN "PRAIRIE DOG" (*Cynomys columbianus*, ♂).

(From photographs.)



JACK RABBIT (*Lepus callotis callotis*, ♂).
(From a photograph by Dr. R. W. Shufeldt.)

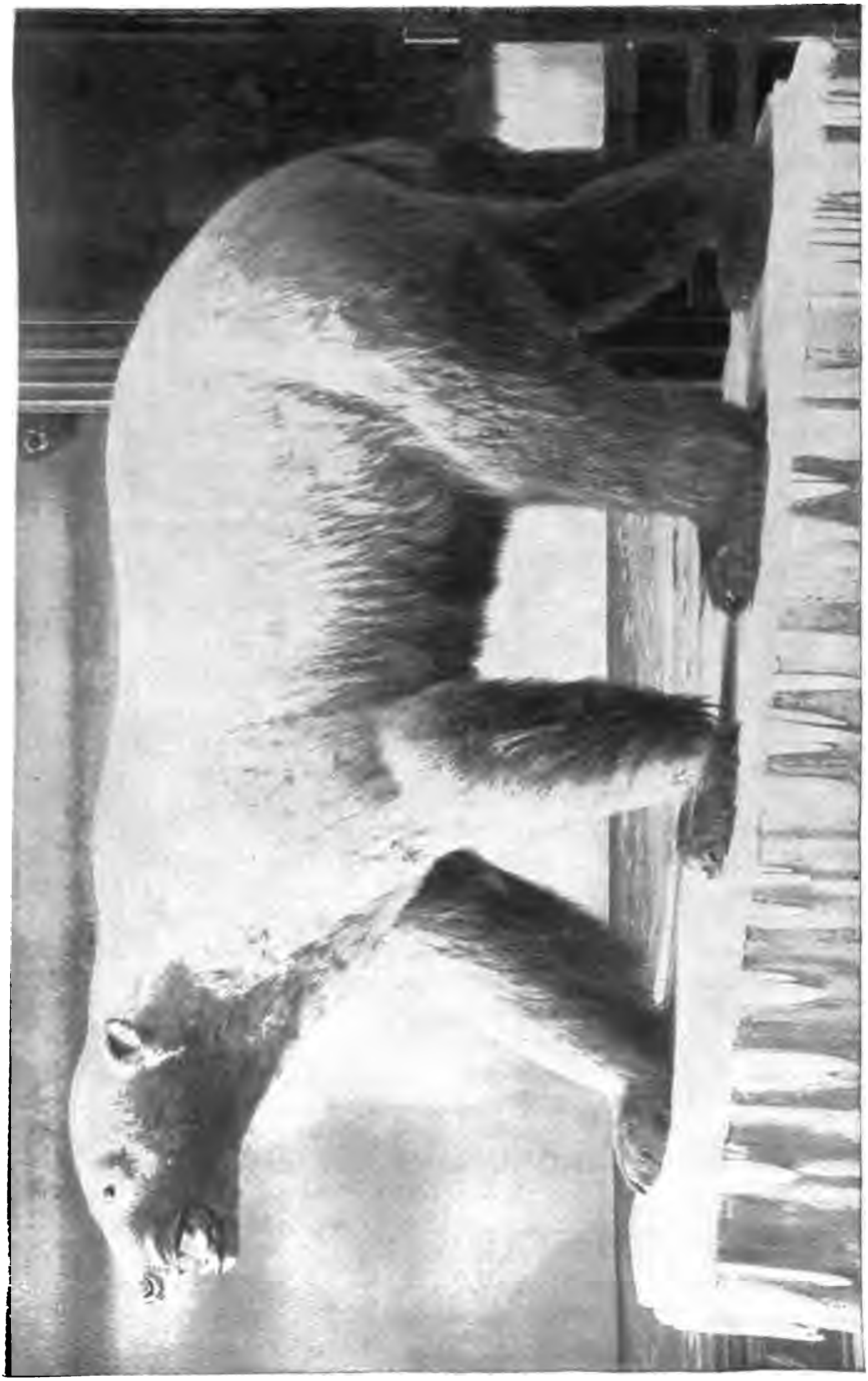
When a person writes in such a strain as this I am convinced he has not made himself master of the instrument, and knows but very little about its capabilities. Why, even my very earliest attempts in this line, in the photography of living and dead mammals in the field, I still claim are of some use, while others of them are highly suggestive. Take the *Cynomys* or Prairie dog, shown in Plate LXXXIII, Figs. 1 and 2. I made that photograph while the animal stood at the very entrance of his burrow. It was in New Mexico. The relative position of the eye, the ear, and the nose are well shown in Fig. 1, while the prominent cheeks are clearly defined in Fig. 2. Whoever it was that mounted the group of these animals at the National Museum I do not now just remember. It may have been Mr. Hornaday, but whoever it was he did not appreciate this prominence of the cheeks in *Cynomys*, and I must believe that such a figure as here given would have enlightened him on the subject.

There is another structure that I have noticed that is rarely well preserved, and that is the ears of large hares. These appendages, as I have studied them in most museum specimens of *Lepus*, always to me appear to be more or less shrunken. This especially applies to the ears of the American Jackass Rabbits (Plate LXXXIV), and the proper preservation of the form, size, and coloration of these is, of course, very important. All these particulars are well shown in the plate, although it is only a dead animal, it being a photograph I made of one of those hares immediately after I shot it. Another example of the kind is seen in my photograph of a dead Badger (Plate LXXXVIII). The attitude here shown corresponds exactly with one which, among others, it assumes while in the act of burrowing, and many a person whom I have shown this picture has been deceived by it to the extent of mistaking it for a live specimen. It gives a first-rate idea of the form of the badger's head, position of ears, etc. Had a full series of even such photographs as these been available, or had it been possible for the explorers in foreign climes to have taken with them one of the many highly convenient forms of cameras now manufactured, and used it intelligently, I am quite confident that, had the older taxidermists the ability to avail themselves of the pictures obtained in this way, we should not have had so many abominable things to look at in the cases of our museums, and be told on the labels that this represented that animal, and that this, and so on. Things, for example, like the flying lemur, shown in Plate LXXVII. Horrid is not the name for such work as it represents, and it is a pity that that taxidermist did not have a good photograph of the head of a *Galeopithecus*, living or dead, when he started in on the specimen. Apart from the head, we see feet that seize nothing, shriveled ears, protruding wires, distorted form—and those eyes!

There is still another class of cases wherein the camera can be made to do great service, and this is where we meet with an animal given to building for its home a large and cumbersome nest, such as is seen in the *Neotoma* group in the collection. With the enterprise now exhibited upon the part of museum collectors and taxidermists, the feat of transporting such a structure from the wilds of the Southwest to the mammal hall of the National Museum would be considered perfectly feasible. But before disturbing such a nest in any way where the rats had originally built it, it would most assuredly be the thing to do to make a good photograph of it, so that, in the event of having to restore or arrange parts of it after its transportation and arrival, we would have the photograph as a model, and the best that could be procured. Indeed, with the material at hand the entire nest could be again rebuilt by it, as for the matter of that.

From the standpoint of the introduction of groups of mammals, illustrating habits, etc., such a nest as this presents the problem of devoting a large piece of valuable space to a very small animal. But we contend here, most emphatically, that the lesson it teaches is fully worthy of it, and these are the very kinds of objects that we should devote our very best pains to introduce, with a strict fidelity to nature, into our zoölogical museums. I would go farther; I would go to the extent of giving many square feet of museum space, and faithfully illustrate in the very best possible manner, a group of beavers and the dam they build. These animals are now being rapidly exterminated in our country, and ere they are gone entirely it is surely our bounden duty to entertain such an idea with the view of carrying it out. Typical beaver dams are quite as scarce as the builders of them, but one should be sought at an early date, photographed from various points of view, and, cost what it may, reproduced at the National Museum.

Few, at the best, realize how rapidly many of our mammals in this country are being forever swept away. We are fortunate at the National Museum in having preserved, in the very best manner, a number of them, but there yet remain a great many more demanding our attention, and, in some cases, our immediate attention. It is the Government's first duty to see to this matter, and Government aid should not be withheld for a moment where such enterprises are on foot, but should, on the contrary, not only propose them, but encourage the undertaking in every possible way. I have always entertained the idea that the education of the people of any country is one of the best, if not the best investment that that country can make, and surely none of us will question but what zoölogical and other museums are great educators. We stand very much in need of a zoölogical museum in connection with our other Government museums, one large building devoted exclusively to everything in the animal series below man. We have no such building at present. We have been very generous to ourselves in these matters on a number of occasions in the past, but the income from it has well repaid us each time, and the benefit therefrom as a whole is simply incalculable. The time is near at hand again when we should think of repeating one of those wise acts, one of those well-put investments.



WHITE OR POLAR BEAR (*Thalassarctos maritimus*).
(Cat. No. 18861, U. S. N. M.)

There is another, and now exceedingly rare animal, it being on the very verge of extinction, which our museum is exceptionably fortunate in obtaining a specimen, before the destructive and thoughtless hand of man eliminated it entirely. I refer to the walrus. This animal's status is now pretty well known to the reading public, through the publications of the National Museum, those of Mr. H. W. Elliot, of William Palmer, and the daily press incidentally to the general question of the seal-fishery problem. The Museum walrus was mounted in the light of all the improvements and skill modern taxidermy could bring to bear upon the undertaking, and the success was complete. It constituted when finished one of the grandest subjects the Smithsonian sent on to the Government exhibit at the Columbian Exposition, where at the present writing it is. On Plates LXXXVI, Figs. 1 and 2, and LXXXVII I am permitted to give a series of figures from photographs taken at various times during the preservation of this colossal mammal. These so clearly represent what I intend they should that special explanation of any one of them becomes unnecessary. The series are destined to be illustrations of the very highest interest for ages to come, and ere another century rolls by, people will regard them with wonder, and that men actually preserved such a brute, in the flesh, will read far more like fiction than a reality. At a far remote period it will be classed with such ideal scenes as prehistoric man engaged in slaying a mammoth or rudely carving upon the tusks of one.

Some of the seals and other marine mammals in the Museum are very fine in every particular, while, on the other hand, some of them sadly need reduplicating, as they, too, are soon to be exterminated. This applies also to the bears, of which there are some very handsome representatives, but none more so than the Polar Bear (Plate LXXXV), of which there is not a finer mounted specimen in the world. He is represented as walking up an ice floe at a slight incline, and from the free upper margins of which hang many icicles. Ice is often wonderfully well counterfeited by using a moderate coat of paraffin over sheet glass, or even wood, and we gain the proper effect through its transparency. The icicles are of glass, of course, and made especially for the purpose, while the *tout ensemble* of the effect is perfect.

When another commodious zoölogical building is added to the present group of Government institutions, I am of the opinion that the correct idea is to not only show groups of animals composed of one species, but to a certain extent faunal groups, wherein can be worked with the greatest advantage many other natural productions of the country where the animals occur, as plants, topography, etc. Now these large groups, if arranged round the wall space, with a varying depth of 5 to 25 feet, may in some cases be made to advantageously merge into each other—that is, to a certain extent, show regional groups and their mergences. For instance, one large case might be constructed to represent an arctic realm, carried down in the foreground and to one side to the seashore, and upon another rocks, glacial ice, sheet ice, and what not, as representing the higher land. Then the foreground should be merged with the background by a skillful artist, so as to carry with it great depth, and offer the opportunity to show peculiarities of a sky perhaps, and the effect of distance, as well as to add other accessories, as a distant shore covered with seals, or, higher up, a herd of caribou. Such a case could be made to contain an entire marine mammalian fauna, and be made far more instructive and imposing than single specimens uncomfortably huddled or scattered through the various cases, absolutely ignoring any zoölogical arrangement.

We have the power and the understanding now to carry out such bold designs, and it is high time that we were about it. The whole tendency is in just such directions, and all it requires is skillful handling. What an object lesson or lessons such groups would be, and this broad and deep country of ours, including every kind of a fauna and flora from Alaska to Florida, thriving in every variety of climate, includes the very series of zones, realms, and areas that should by just such means be illustrated. It would represent ideas and groups of ideas, and ideas are what we want. It would powerfully illustrate literature as the biologist now makes it for us, and in an orderly manner show our people what we mean by faunal areas, Arctic realms, geographical ranges, variations of animals under varying conditions of altitude, desert areas, and shore lines. Museums, among other things, are made to educate the people of a nation; but a favored few of the people can study such things in nature. So it is the business of the museum to bring whole living sections of nature within its walls, where it can be studied and where books and labels are displayed in abundance to help show how it ought to be studied.

When we can make such animals and groups of animals as those shown in Plates LXXXIX, or LXXIX, or LXXXI, there can be no question in the world but what the more extensive groups can be combined with more telling effect. But to be successful in the highest sense of the word there must be no cheap designers, cheap modelers, cheap artists, or cheap anything employed; all must be of the very best that the United States affords—and we have it in both talent and material. Especially for the painted backgrounds should an artist of the very highest ability be employed, with a staff of others to assist in the introduction of distant animals, forests, or marine effects. If refinement, knowledge, science, and art are wholesomely combined in such efforts there is not one bit of danger of either producing a cheap museum effect, much less anything that savors of the scenery of the theatrical stage. In one sense it would be far more economical, in the same proportion that it is far more so to make one large case of animals than it is to build up six or eight small ones.

Then the space throughout the Museum halls, apart from the regional

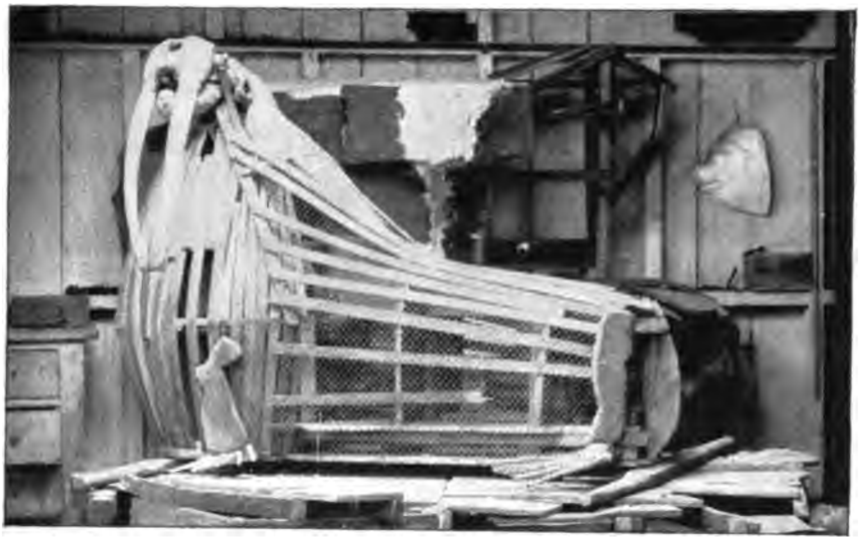


Fig. 1. MANIKIN FOR A WALRUS.
(Partly completed.)

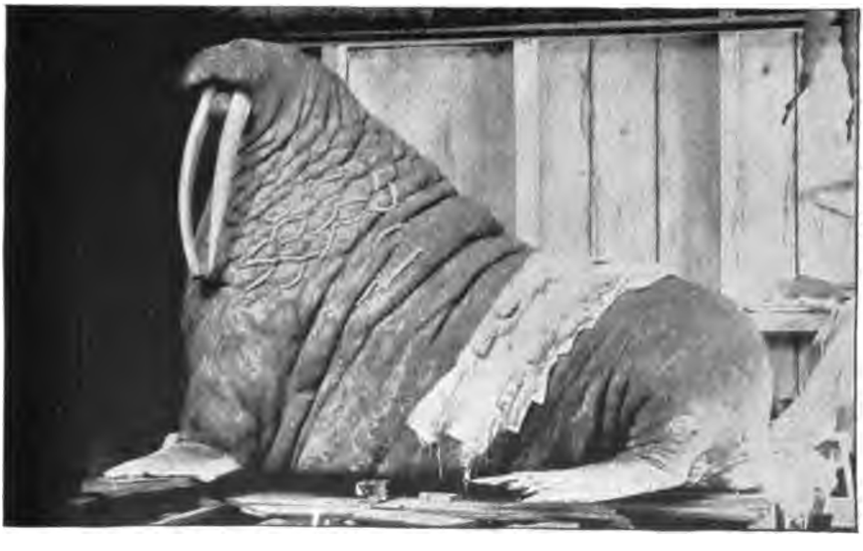
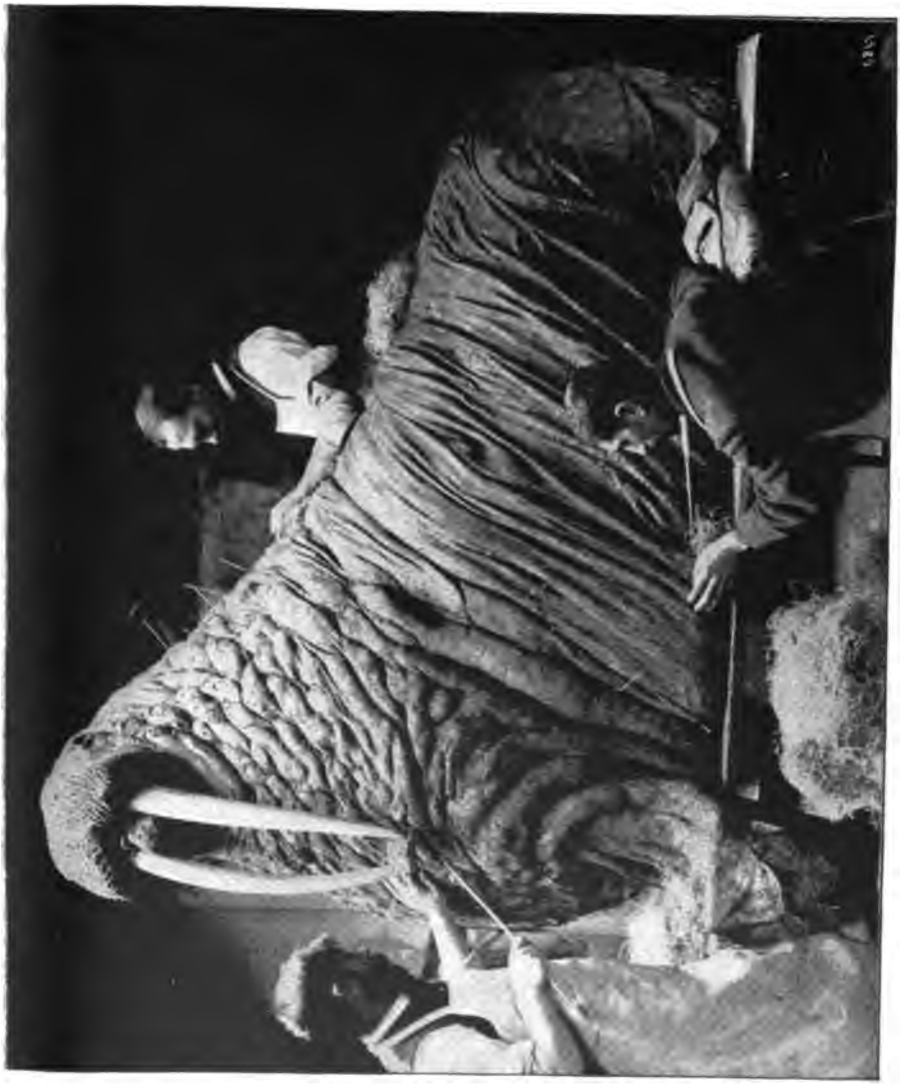


Fig. 2. WALRUS (*Odobœnus obesus*, ♂).
Nearly completed. (Cat. No. 19245, U. S. N. M.)



WALRUS (*Odobænus obesus*, ♂).
In course of completion. (Cat. No. 19945, U. S. N. M.)

groups occupying the walls, could be advantageously devoted to cases of the smaller species groups, single pieces, and other specimens.

Coming to the *Felidæ* in the collection of the Museum we find it represented by specimens similar to those in the other groups, in other words by the good, by the bad, and by the indifferent, and these are the most undoubted examples of every genus of this provisional classification. We see a specimen of the last-mentioned kind in the lynx shown in Plate XC, wherein faults about the mouth, slightly wrinkled ears, and some minor points debar it from the category of the best specimens of taxidermy. While on the other hand the grand specimen of a tiger, the head and fore part of which is given in Plate XCI, has not its peer for that species in any public museum in the United States. The Puma is also another admirable preserved specimen of this group.

Of this group Hornaday has said that the "large *Felidæ* (tiger, lion, leopard, etc.) are the finest subjects for the taxidermist that the whole animal kingdom can produce. They offer the finest opportunities for the development of muscular anatomy, and the expression of the various higher passions." (Taxidermy, p. 171.) This may be very true, but in my opinion the pieces left by this talented artist to commemorate his name after his connection with the Museum was severed, and the ones which will most surely pass his name down into history as a most masterly taxidermist of his time, are the group of American bison, and "Mungo" the African elephant, though his Bengal tiger, to gain a similar place, be stepping in the very footprints of the latter as he leaves them.

One who has not seen the feat performed in one of our larger museums can have but little conception of the skill required in handling the facial expression and all the structures that enter into the mouth parts. The skinning of a tiger's tongue and preserving it so as to make that organ resemble the original as it appeared in the living subject; the cleaning of the teeth; the blending of the black part of the lips with the delicate pink gums inside; to make the animal grin and not smile, and to lend to the eyes the flash of anger, are all accomplishments that demand of the artist his best judgment, knowledge, skill, and, what is more, his infinite patience.

I agree with him when he says:

> Some of the old-fashioned taxidermists have the habit of smearing a lot of nasty lampblack in the eyes of every mounted mammal [and a variety of birds, too], for what purpose no one knows, but possibly in imitation of actresses, some of whom have the same unaccountable trick, and a hideous one in its results in both cases. There is only one point in its favor: it is the easiest way in the world to give an animal a black eye. (*Ibid.*, pp. 177, 178.)

Many groups of monkeys and the higher apes now adorn the cases in the mammal department of the U. S. National Museum. Some of these are among the best groups of the kind in the hands of the institution. Among them is the now famous group of Orang-utans, too well known to require description in this place; and there are others of equal beauty and interest.

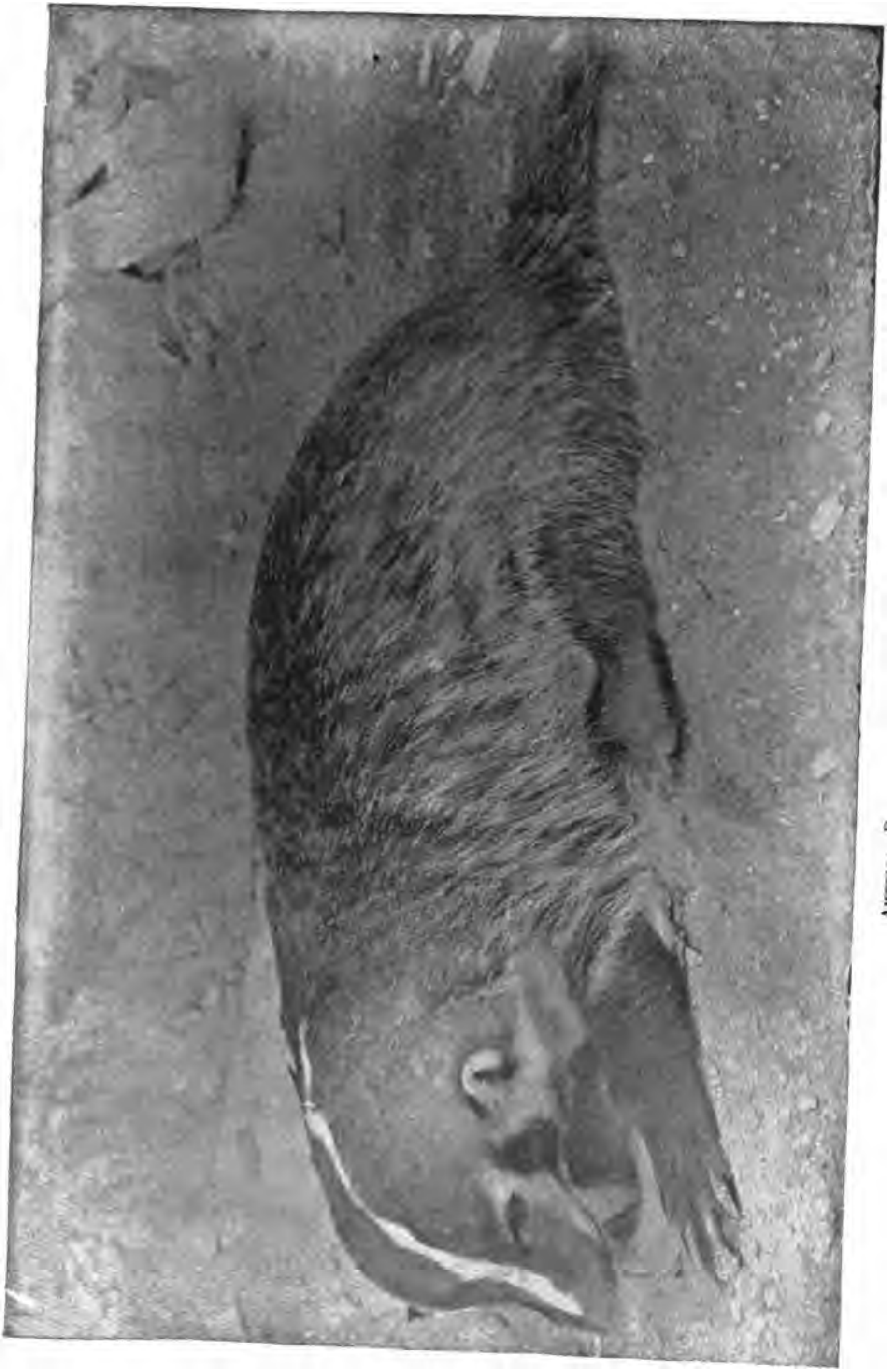
Of recent years a great deal of well-directed energy and skill has been brought to bear to reproduce various races of men, and these attired in their native costumes and represented in the pursuit of various employments. They are, as a rule, the size of life, and so real in the majority of instances as to excite the wonder and admiration of all who chance to behold them for the first time. But this subject has been found too extensive to handle in the present connection, and it will no doubt furnish the material for another writer at some time in the near future. If ever the Museum indulge in the mounting of such groups, the propriety of which seems to be questionable, as Jules Verreaux's "Arab courier attacked by lions," or John Wallace's famous "Horseman attacked by tigers," and similar efforts, why this would appear to be the more proper place for them, rather than any department of zoölogy. If not showing too much or great activity, or otherwise not too sensational, some such compositions are quite instructive, and to the public always interesting.

So far as I am aware at present, the Museum has never undertaken to preserve man, by any other process than the ones now employed, of clothed manikins, the faces and heads being obtained by casts or other means. That the direct preservation of man's body intact has been elsewhere attempted, however, there can be no doubt, and with some measure of success. On page 14 of Capt. Brown's little work on taxidermy, I read:

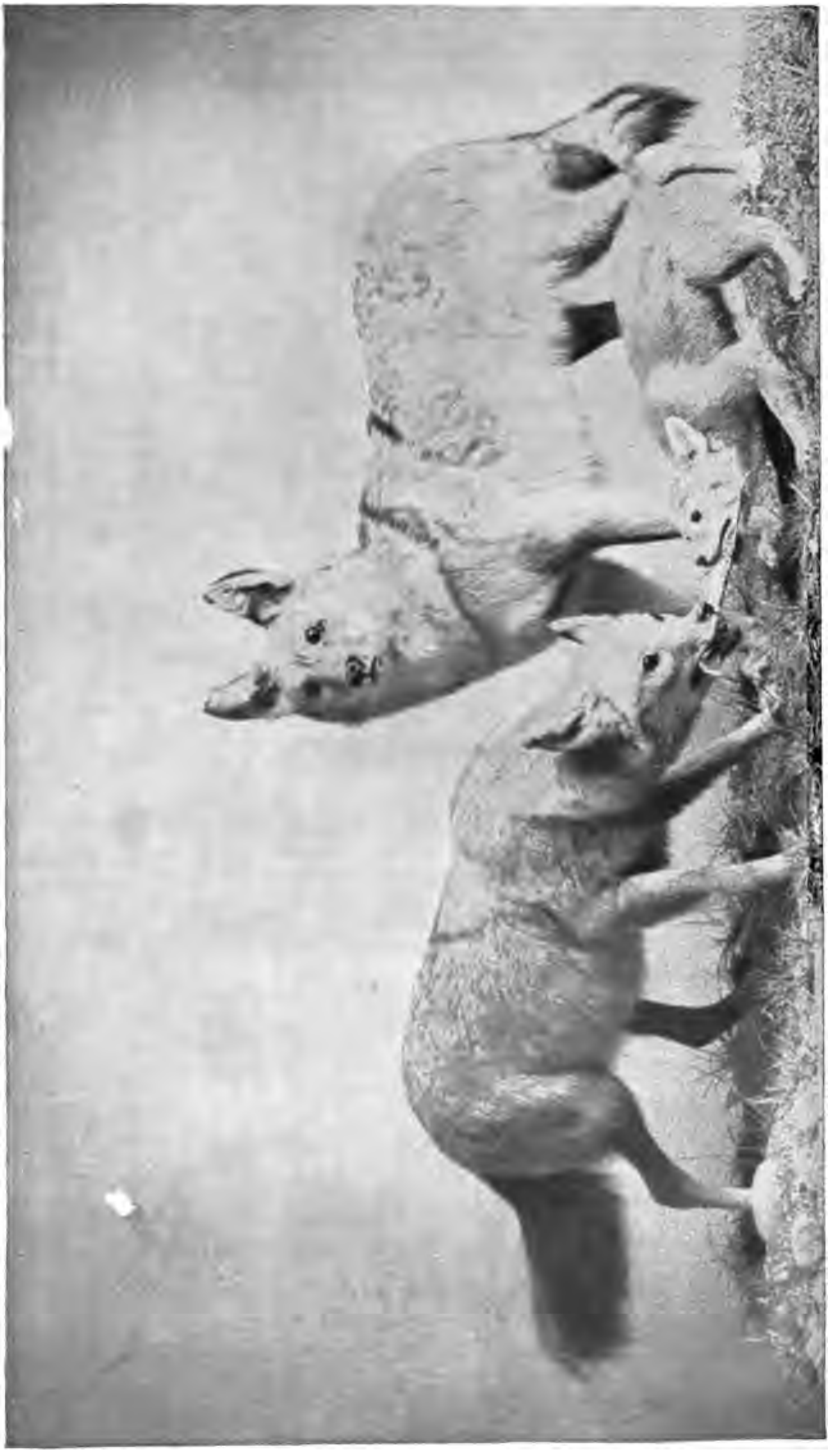
> Numerous have been the attempts of mankind to preserve the skin of their fellow-creatures. The very best of these have been most disgusting deformities, and so totally unlike the "human form divine" that none of them have found a place in collections, with the exception of some parts of man, which form part of the European anatomical collections. In the museum of the Jardin du Roi, at Paris, there is one of the best things of this kind which we have seen, a human head injected and preserved in spirits of turpentine. This curious preparation was the production of Rintch, a Dutch physician, highly celebrated for his pathological skill. The precise manner this interesting preparation was originally preserved is not known. However, it retains to the present day, all the original and natural colors. In winter, the cold affects the spirit so much, in which it is preserved, that the head can not be distinguished, until the return of warm weather, which dispels its cloudy appearance. The New Zealanders have a method of drying and preserving the heads of their chiefs, with the flesh entire. Many of these are to be found in museums; but they are of little use, and by no means calculated to produce pleasurable sensations.
>
> We may safely predict that no method will ever be discovered, by which man can be preserved so as to be fit for placing in a museum. (1870.)

Could Capt. Brown but see the host of thoroughly lifelike Indians, Africans, Japanese, Samoan, Aino, Esquimau, and Caucasian figures, of all ages, and both sexes, that Prof. O. T. Mason now marshals in his department, he could have but one opinion about it, and that is that the necessity therefor had gone by.

As I closed upon a former page of this paper what I had to say 'bout the taxidermy of birds, I passed a few brief remarks upon the



AMERICAN BADGER (*Taxidea a. americanus* Boddært).
(From a photograph of a dead specimen.)



A GROUP OF COYOTES (*Canis latrans* Say).

(Cat. Nos. 15491, 15707, 15708, U. S. N. M.)

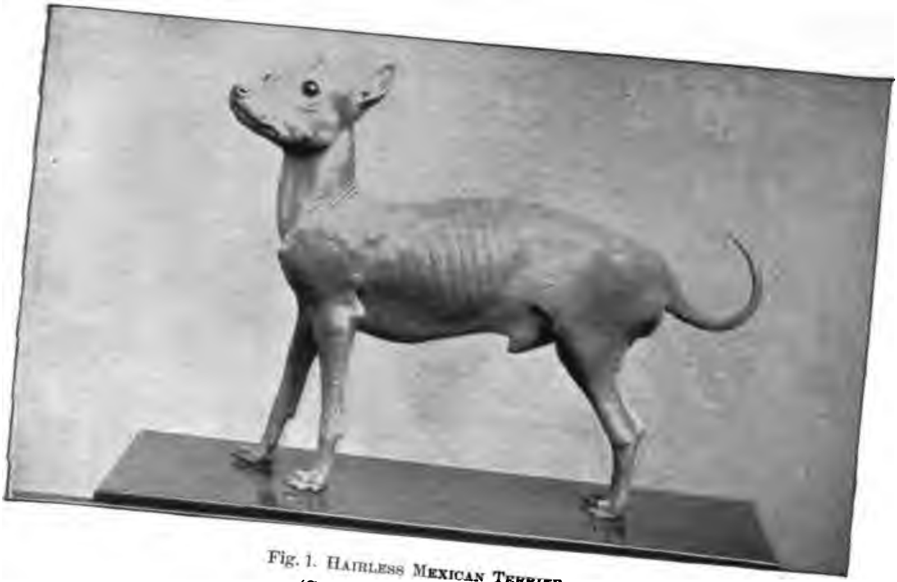


Fig. 1. HAIRLESS MEXICAN TERRIER.
(Cat. No. 116718, U. S. N. M.)

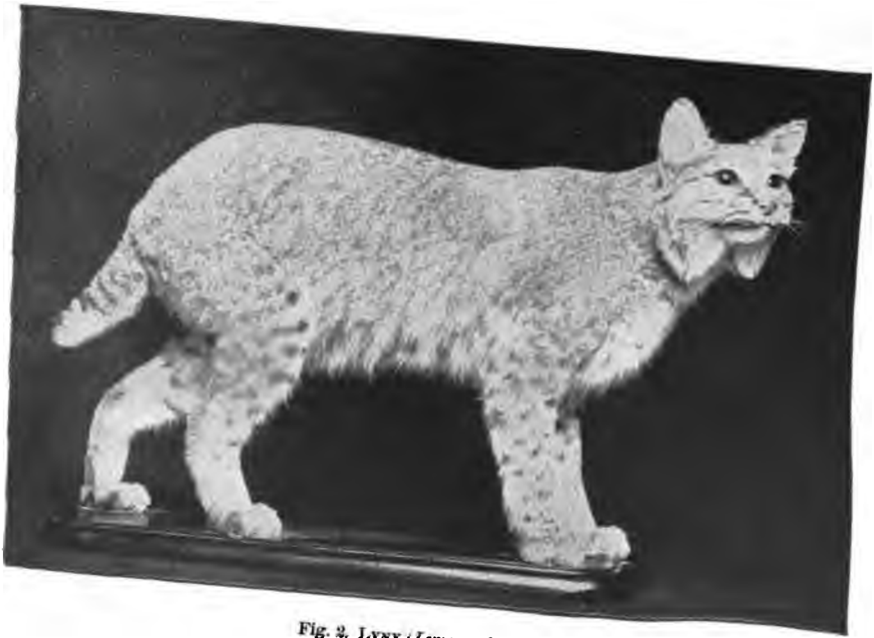
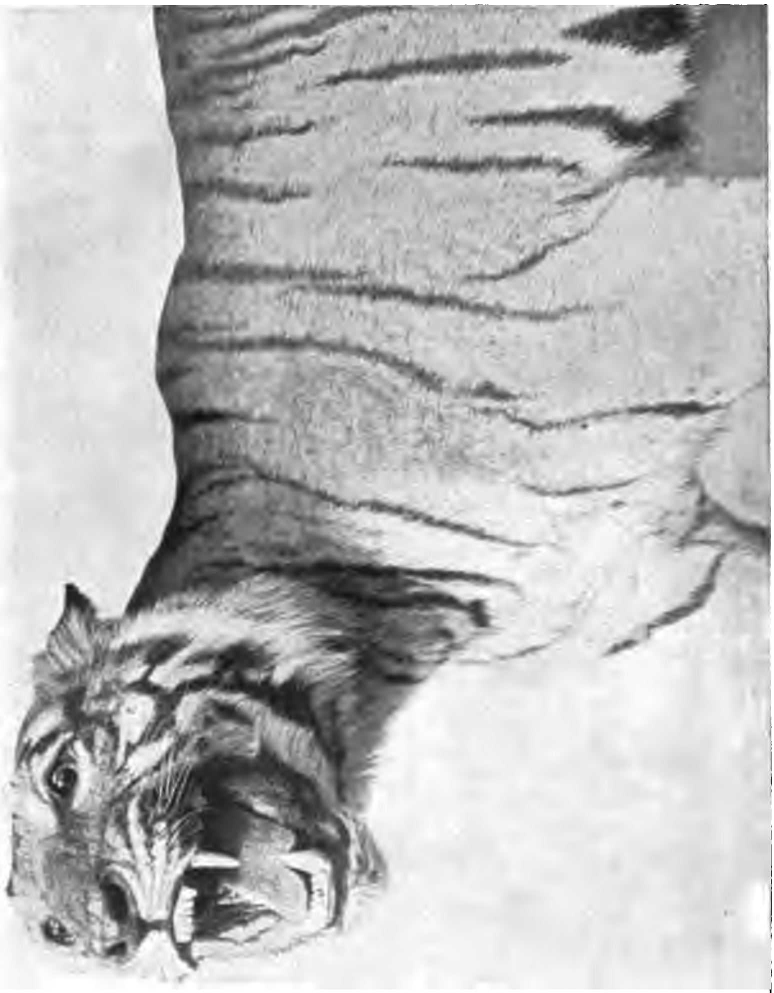


Fig. 2. LYNX (*Lynx rufus*).



HEAD OF TIGER (*Felis tigris*).
(Cat. No. 15387, U. S. N. M.)

hall in which their cases were exhibited. In this particular the mammal department is far better off. It being in the National Museum building proper, a comparatively more modern structure, it is both well lighted and well ventilated. The casings are of the most recent improved kinds, and set off their subjects very satisfactorily. An object of great interest, and suspended from the roof, is the vertical mid-section of a hollow papier mâché whale, into which has been placed a skeleton of the same species *in situ*. It renders a fine idea of the position of the osseous framework of this huge marine mammal.

CONCLUSIONS.

In writing out the account of my observations and in giving my opinions for this report on the present status of the art of taxidermy, and what may be hoped for it in the future, I have been very largely influenced by what I have seen and been enabled to study in the collections of the U. S. National Museum and Smithsonian Institution at Washington, D. C. When my labors were first undertaken it was the intention to incorporate herein descriptions of methods and work, with the appropriate plates illustrating it, of many other museums, both here and in Europe. In some few instances this has been accomplished, while from one reason or another it has failed in others. Often institutions of the kind we speak are more or less sensitive on the point of submitting their work for an impartial criticism, and so withheld it; while in others such a very large proportion of the work was so far below the standard of what taxidermy ought to be in these days, that for very obvious reasons it has been placed aside without notice. Looking broadly over the field and taking the subject as a whole, I am of the opinion that there is, even in many of our first-class museums, very wide room for improvement in such matters. My aim has been throughout this entire paper to accord full praise where it appeared to be justly merited, and in those cases where the work was below what it ought to be I have endeavored to keep myself above mere fault-finding by simply indicating the only too apparent errors. We are to be congratulated that the art is making such very satisfactory progress among us, and that at the present writing, in our most advanced institutions, Government and otherwise, there is to be found so much to be praised and recommended and so little to be condemned.

Much might be said here on the subject of suitable museums for the exhibition of scientific collections of preserved animals, but this phase of the question will be, as has been said, dealt with in another place. Be it enough to say here in passing that our Government museums are as yet very faulty in this particular and far behind some of the better institutions in, for example, England and elsewhere. The old ornithological hall in the Smithsonian building is already crowded to overflowing, and is at the best but illy suited for the purpose, a large proportion of the recesses being so very dark that the specimens can not be properly seen, much less studied. The National Museum building is better fitted for the exhibition of ethnological and other material than it is for zoölogical. We stand in need, very much in need, of a scientifically constructed zoölogical museum, for, in the first place, to properly exhibit the superb collections that have within comparatively recent times grown up here, and, second, to relieve the buildings already in use. As the British Museum threw off its South Kensington Department of Natural History, so has, and from like causes, the time come for us to make a similar step.

I have called attention to the fact that taxidermists should be thoroughly educated men, fully trained in all the technique of their art in its broadest sense, as pointed out in the body of the paper; that with respect to the art itself, the main factors of success to be observed are the using of every means at our command to reproduce nature in every particular, not only in the case of the specimens themselves, but in the accessories used in connection with them; that they should be so prepared as to resist in every way the ravages of time, or the attacks of pests; that they should, in addition, not only show the appearance of the animal itself, but aim to give a chapter in its life history, drawing therefor either upon its habits or its habitat; that everything that in any way whatever partaking of the grotesque or fanciful or extravagant innovations should be promptly and forever discountenanced.

My studies have led me to believe that the art of taxidermy has had a singular evolutionary growth peculiarly its own, the various phases of which have, in one place or another, been pointed out in the foregoing pages, and that of recent years the strong tendency in our leading museums has been to group animals, and for a variety of purposes. I am convinced that in the future museums will carry this idea still further, and that these groups will be so combined as not only to exhibit single species, showing some of their habits and surrounding in their natural haunts, but also to a very large extent to show faunal regions, and the animal and plant life of various geographical areas. When thus presented in the museums of large cities, and showing in that way the distribution of the animal and plant life of the region wherein the particular city may be situated, or for the country at large in our Government museums, the ever-present lesson they will present for study to the thousands of men, women, and children who may see such an exhibition during the course of a year will in its practicable value be simply beyond all calculation. By such arrangements the eye will be enabled to take in and the mind appreciate the aspect and the biologic forms of any particular region of the United States almost at a glance.

For the sake of economy, both for the present and the future, we should employ only the very best materials in our work, and, what is quite as important, secure the services of only the most skillful and advanced artists in the country. Not mere plodders for pay, but men thoroughly in love with their work and possessing talents fully capable of improvement and desirous of seizing upon each and every advance made in the art. To this end, whenever proper opportunity offers, facilities to inform themselves in all that directly relates to their work should be extended to them.

In closing, I but acquit myself of a duty and a pleasure at once when I extend my thanks to Prof. G. Brown Goode, long in charge of the National Museum, not only for the advantages that have come to me in the way of studying the material for this paper but for the pleasure it has been for me to write it, and for the many courtesies I have received at his hands.

To Mr. F. W. True I am especially indebted for the assistance he has so freely given me upon every occasion. As the curator-in-charge of the Museum, it has lain within his power to further my labors in numerous ways, and this throughout has been done with such marked kindness, promptitude, and cheerfulness that I find it difficult for me to express to him the gratitude I experience for it and so thoroughly feel.

My own work will have been amply repaid if it result in the further encouragement and stimulation of the progress of the art of taxidermy, now so firmly placed on foot in so many quarters of the civilized world.

APPENDIX.

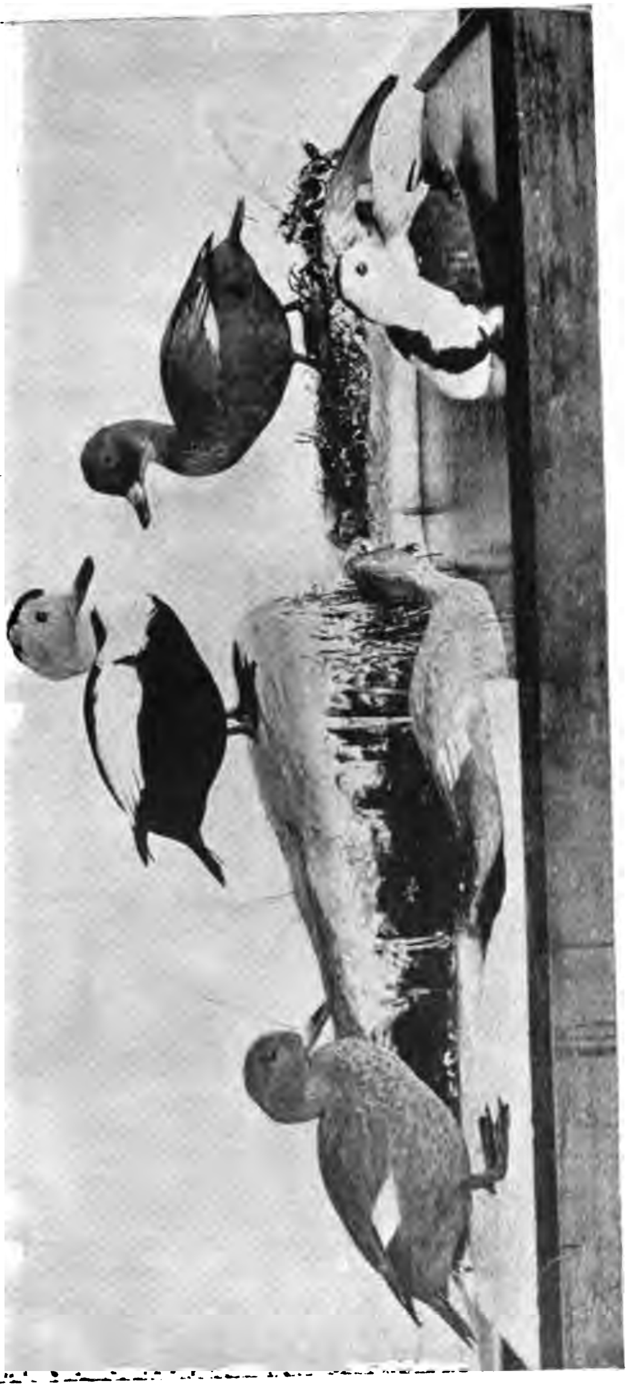
After the manuscript of this paper had been completed, and had been transmitted to the Museum for publication, there were received for incorporation in it, through the kindness of Dr. J. A. Allen, of the American Museum of Natural History, New York City,. five photographs for plates. These photographs represent groups in the collections of the American Museum of Natural History, in which institution Dr. Allen has charge of the departments of ornithology and mammalogy. They came too late to be inserted in the body of this paper, but owing to their general excellence and interest, and to the great courtesy of their sender in submitting them, as well as to the trouble which he had taken to write out their histories, it was decided to have them engraved and placed together at the end of the paper. The first of these added plates (Plate XCII) represents a group of Pied Ducks (*Camptolaimus labradorius*) which were designed and prepared by Jenness Richardson in 1889 at the American Museum of Natural History. The birds were mounted by Mr. H. C. Denslow.

The group which is represented in the second plate of this series (Plate XCIII) is a more or less elaborate piece of work, also designed and prepared by Mr. Richardson at the American Museum of Natural History in 1886. It represents very faithfully the side elevation of a bank, part way down in which a pair of Louisiana water thrushes (*Siurus* *motacilla*) have built their nest. The male and female birds are seen approaching it, as they leisurely hop along the roots and twigs of plants which protrude from the side of the bank.

Of all the specimens on exhibition in the collections of the American Museum, none have a greater attraction for the observer and visitor there than the admirable series of bird groups, and one of the most life-like of these is the beautiful subject of the third plate in this series (Plate XCIV). It represents a pair of robins (*Merula migratoria*) with their nest in an apple tree, the latter being in full bloom of early summer.

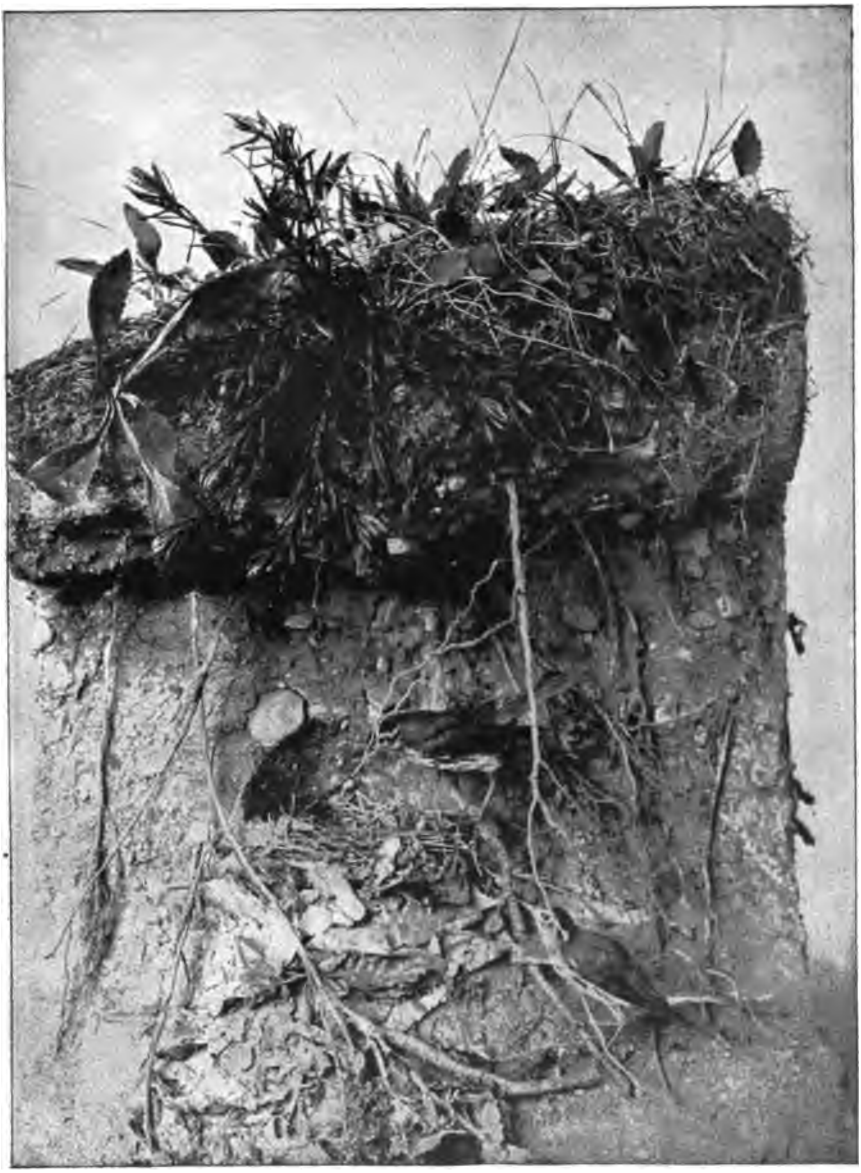
The fourth plate in the supplemental series (Plate XCV) represents a group of opossums (*Didelphis virginiana*), male, female, and a number of young ones. In many respects it resembles the similar groups of these animals which are to be seen in the U. S. National Museum, and which have been described in the body of this paper. The group represented in this plate was prepared and designed by Mr. Jenness Richardson at the American Museum of Natural History in 1891. It is an especially fine piece of work, and although it does not contain as many specimens as the National Museum group, it is hardly the less instructive on that account.

In so far as the larger mammals are concerned, there is probably not a piece in the entire collection of the American Museum of Natural History that can in any particular compare with the superb specimen of the huge pachyderm shown in Plate XCVI. It is the Indian rhinoceros "Bombi" (*Rhinoceros unicornis L.*). This specimen was mounted at the American Museum of Natural History in 1890 by Mr. Richardson and his assistants. The data for the work consisted in measurements taken from the animal when alive, and also from a photograph obtained at the same time. After having been mounted, it was properly colored after a living specimen in the Zoölogical Gardens of Philadelphia. It is probably one of the best mounted specimens of this species in the United States.

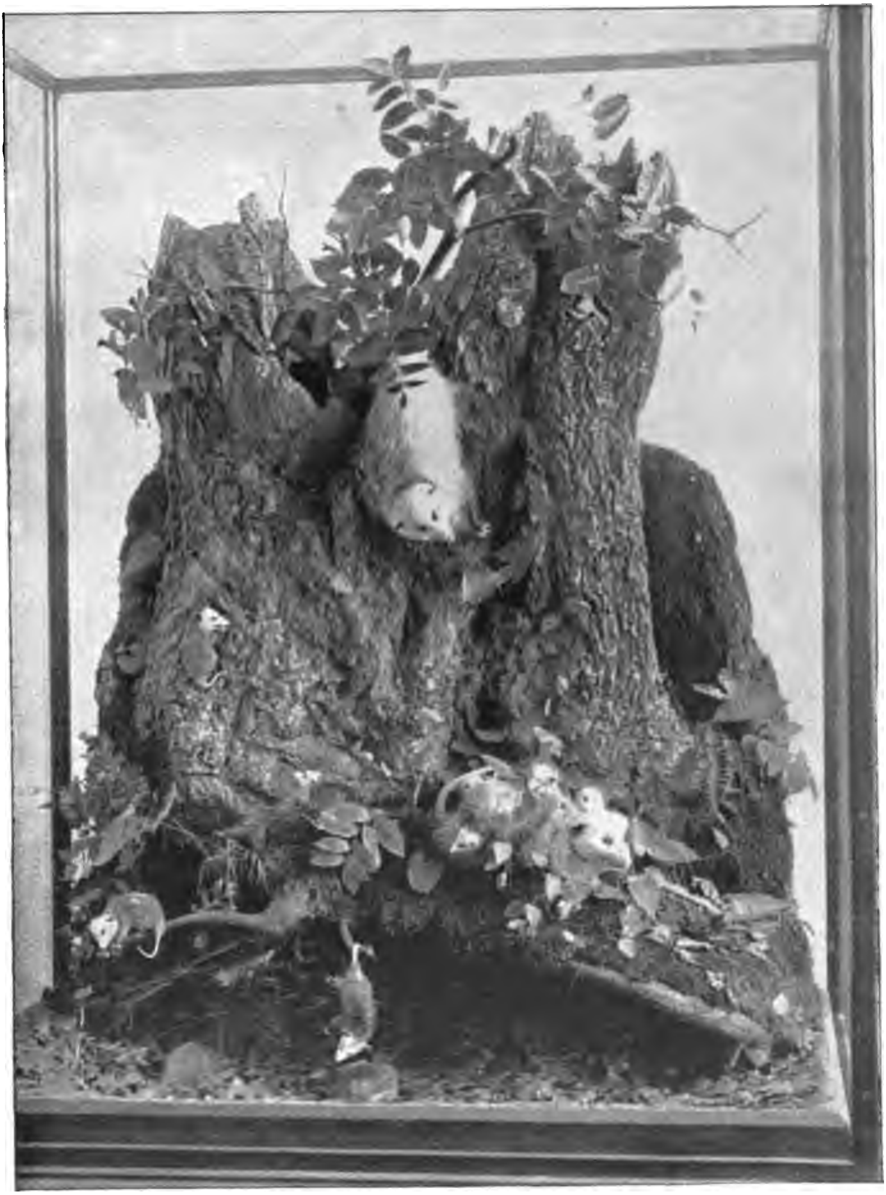


GROUP OF LABRADOR DUCKS (*Camptolaimus labradorius*).

(From an electrotype lent by the American Museum of Natural History, New York City.)

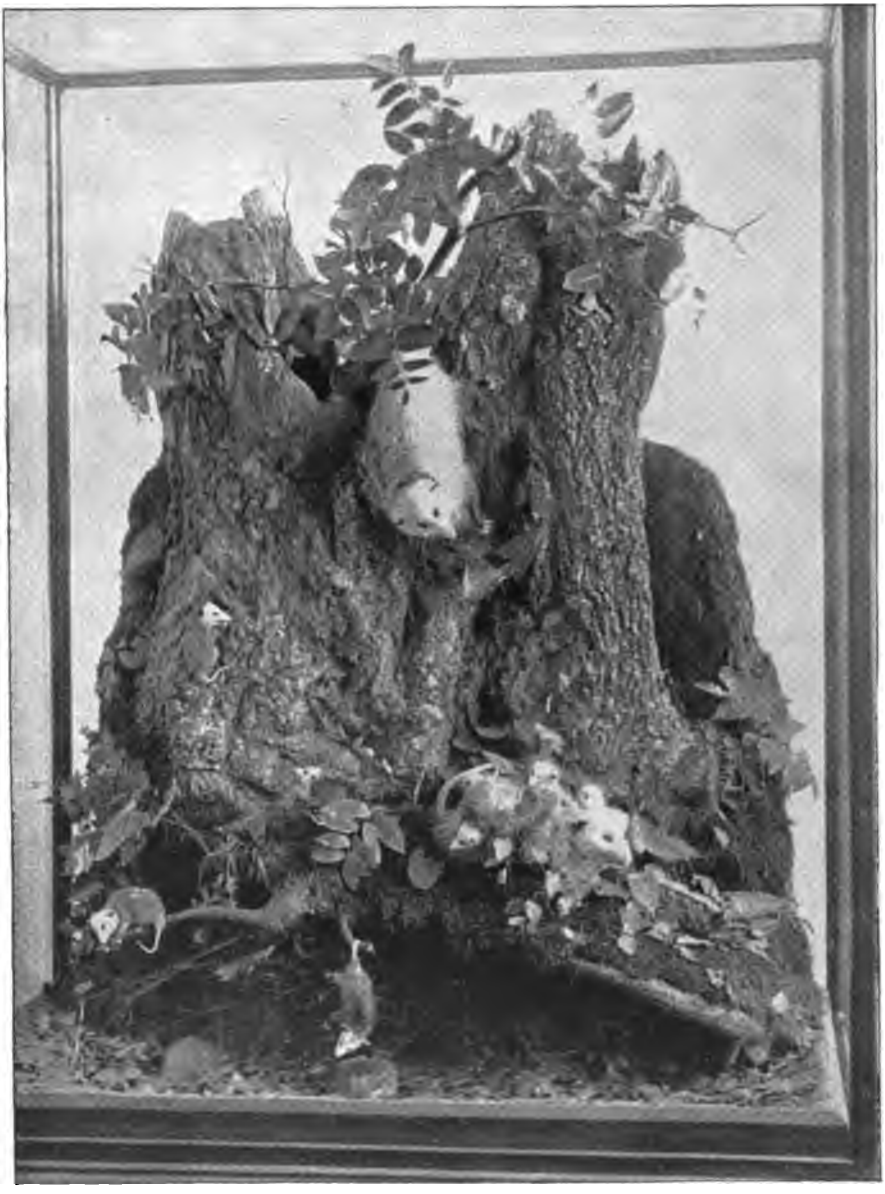


A PAIR OF LOUISIANA WATER THRUSHES (*Siurus motacilla*) AND NEST.
(From a group in the American Museum of Natural History, New York City.)



GROUP OF OPOSSUMS.

(From an electrotype lent by the American Museum of Natural History, New York City.)



GROUP OF OPOSSUMS.
(From an electrotype lent by the American Museum of Natural History, New York City.)

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THE SHOFAR—ITS USE AND ORIGIN.*

By Cyrus Adler, *Assistant Curator of Oriental Antiquities.*

The modern Jewish synagogue has preserved in its ceremonial, among other customs, the use of the shofar, translated in the English version of the Bible "cornet." Several times during the service on New Year's day, or *Rosh hashanah*, at the conclusion of the Day of Atonement, on the seventh day of the festival of Tabernacles or *Sukkoth*, *Hosh'ana Raba*, and during the entire month of Ellul, after the recital of the supplications or *Selichoth*, the shofar is sounded. Its use on all these occasions is not general and probably never was, but it still survives in many places. For the New Year's service it is the characteristic feature.

The shofar is usually made of a ram's horn, straightened and flattened by heat. All natural horns can be shaped either by heat or by cooking in oil.†

The bore of the instrument is a cylindrical tube of very small caliber, which opens into a kind of bell of parabolic form.‡

It is not only the solitary ancient musical instrument actually preserved in the Mosaic ritual, but is the oldest form of wind instrument known to be retained in use in the world.§

In the discussion of Wetzstein's paper, cited below, Prof. Steinthal pointed out that this was an instrument no doubt used in prehistoric times.

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* In the abstract of this paper published in the proceedings of the American Oriental Society, October, 1889, p. CLXXI, ff., I made the request for the communication of additional information on the subject, and I have been favored with some valuable suggestions from the late Prof. Paul de Lagarde, of Göttingen.

† I have recently met a curious survival of the use and manufacture of a musical instrument made of natural horn. While walking on Pennsylvania avenue, Washington, August 22, 1890, I saw a negro boy about 10 years of age with a cow horn in his hand. He told me that he had cut off the end, shaped the mouthpiece with a hot poker, and then scraped it with a knife. On being urged, he blew it quite easily. I endeavored to secure possession of it, but the boy declined to part with his handiwork.

‡ Musical Instruments Historic, Rare, and Unique, by A. J. Hipkins, Edinburgh, Black, 1888, p. 12.

§ *Ibid.*, p. 1, and South Kensington Museum Art Books, edited by William Maskell; Musical Instruments, by Carl Engel, London, 1875: Chapman & Hall, p. 24.

There seems to be little doubt that it has been continuously used in the Mosaic service from the time it was established until now. (Hipkins, XII.)

FORM.

The shape of the instrument varies considerably. The modern examples are usually flat (Pl. XCVII, Fig. 1). Two Italian specimens of the seventeenth century preserve the form of the natural horn; the first of these is in possession of the Rev. Dr. S. Morais, of Philadelphia; it was procured for him from Venice by Dr. Isaiah Luzzatto, of Padua. The second Italian specimen (Pl. XCVII, Fig. 2) was collected by Dr. H. Friedenwald, and belongs to the National Museum collections. The same shape is exhibited in a beautiful example figured by Hipkins (Pl. XCVIII, Fig. 1), preserved in the Great Synagogue, Aldgate, London. A number of excellent specimens were brought together at the Anglo-Jewish Historical Exhibition, held in London in 1887. They are figured in the accompanying plates and briefly described in the list of illustrations. Occasionally the instruments contain Hebrew inscriptions. Such an one, found near Dessau, was exhibited before the Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, at the meeting of March 20, 1880, and formed the subject of a valuable paper by T. G. Wetzstein (pp. 63-73. See Pl. XCVIII, Fig. 3). A similarly carved and inscribed instrument is in possession of a lady in New York (Pl. C, Fig. 1). The inscription reads: "Happy are the people who know the sound (of the shofar)," and on the reverse, "In the light of Thy countenance shall they walk." The inscription on the Dessau instrument consists of Isaiah xxvii, 13 (quoted below), and the two blessings recited by the person who blows the instrument: "Blessed art Thou, O Lord, our God, King of the Universe, who has sanctified us with His commandments and commanded us to hear the sound of the shofar;" "Blessed art Thou, O Lord, our God, King of the Universe, who has caused us to live, and preserved us, and caused us to reach this time." (Wetzstein, p. 65.)

The shofar was not the only natural horn used by the Israelites as a musical instrument, but no copies or representations of the other instruments have come down to us.

Some commentators are of the opinion that the instrument known in the Bible by the generic name of *qeren*, was also made of ram's horn, and was very nearly identical with the *shofar*, the only difference being that the latter was more curved than the former. (Engel., p. 24.)

METHOD OF SOUNDING.

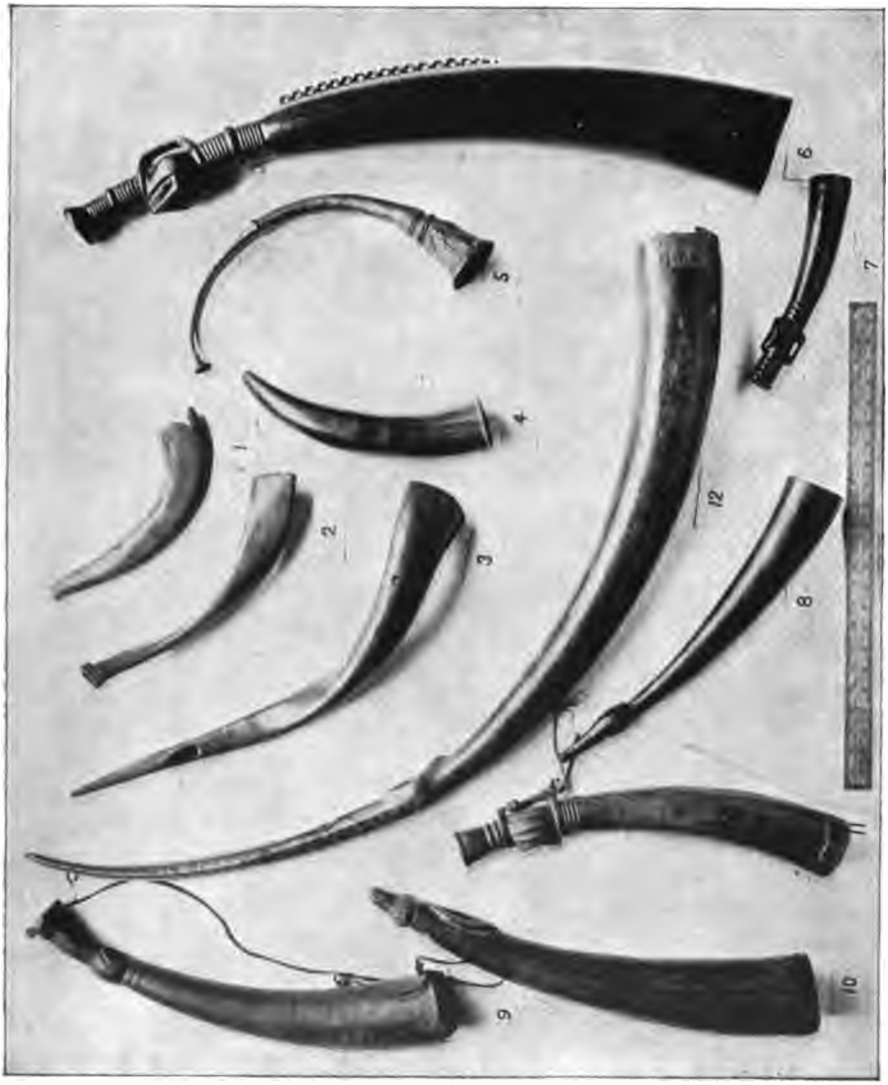
The method of sounding the shofar has been handed down by tradition, though it varies slightly in different communities. Three sounds are employed: the shortest, or *teqi'a*, a broken or interrupted sound,

EXPLANATION OF PLATE XCVII.

SHOFARS AND OTHER HORNS.

Fig. 1. Modern shofar, ordinary form. (Cat. No. 154402.)
2. Shofar, Italian form. (Cat. No. 95142.)
3. African war horn (antelope). (Cat. No. 4960.)
4. Shringa. (Cat. No. 92709. India.)
5. Siamese copper horn. (Cat. No. 27293.)
6. Large African war horn of ivory, from plaster cast in National Museum. (Original in museum of Wesleyan University, Middletown, Connecticut.) (Cat. No. 94892.)
7. Small African war horn of ivory, from plaster cast in National Museum. (Original in museum of Wesleyan University, Middletown, Connecticut.) (Cat. No. 94893.)
8. Ivory war horn. (Cat. No. 127193. Byanzi, Africa.)
9. African war horn. (Cat. No. 5412.)
10. Embuchi; Ivory war horn. (Cat. No. 4793. Pala Ballas, Africa.)
11. Ivory war horn. (Cat. No. 4793. West coast of Africa.)
12. Ivory war horn. (Cat. No. 127195. Byanzi, Africa.)

PLATE XCVII.



SHOFARS AND OTHER HORNS.

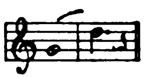
shebarim, consisting in the *teqiʿa*, given three times, and *teruʿa*, which is simply a prolongation of the *teqiʿa*. *Teruʿa gedola*, or the great teruʿa, is merely an exaggeration of the simple sound of that name. The German Jews sound the *teqiʿa gedola* or great *teqiʿa*. (Hipkins, p. xiii.)

The sound is produced by the ejection of a volume of air into the trumpet through the lips, which act as a reed, pressed against the orifice of the trumpet.

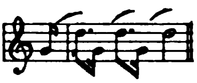
According to Hipkins the embouchure of the shofar is very difficult, and but three proper tones are usually obtained from it, although in some instances higher notes can be got. The short rythmic flourishes are common, with unimportant differences, to both the German and Portuguese Jews, and consequently date from before their separation. These flourishes, as used in the ritual, are *teqiʿa* CG *shebarim* C | GC | GC | G and *teruʿa* CCCC | CCCC | CCCC | G usually a tongued *vibrato* of the lower note. The *gedola* is the great *teqiʿa* concluding the flourishes (p. xiii). "The notes here given are those usually produced, but from the empirical formation of the embouchure, and a peculiarity of the player's lips, an octave is occasionally produced instead of the normal fifth." My own observation has led me to the conclusion that the production of the octave is quite common. The fundamental, if obtained, is not regarded as a true shofar note.

Wetzstein gives the following musical notation.

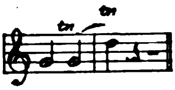
Teqiʿa.



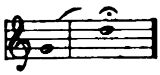
Shebarim.



Teruʿa.



Teqiʿa gedola.



According to *Mishna Rosh hashana* (IV, 9) the order of sounding the shofar is as follows: the sounds are blown thrice, the time of the duration of the *teqiʿa* is equal to that of three *teruʿas*, and that of each *teruʿa* is equal to three disconnected notes.

From this it would appear that the interrupted sound or *shebarim* was not known when this Mishna was written. This conclusion, however, can not be drawn with certainty.

THE SHOFAR IN THE LITURGY.

Portions of the liturgy for New Year's Day have especial reference to the sounding of the shofar. First among these is the hymn, *Adonai beqol shofar*, by an unknown author: "With the sound of the trumpet will the Lord publish salvation, to assemble the scattered sheep at the coming (accomplishment) of the vision of salvation. God is exalted with a triumphal shout."

"With the sound of the trumpet God causes a voice to be heard from heaven, on the holy mountain, and on Jerusalem; then shall the place be established, by Thy right hand shall be restored to its primitive state. God is exalted with a triumphal shout."

"With the sound of the trumpet the Lord will reveal the period and appointed time, when He will blow the trumpet and go in the whirlwinds of the south; then shall the wicked kingdom of Edom be destroyed. God is exalted with a triumphal shout."

"O Lord, with the sound of the trumpet wilt Thou blow upon the holy mountain; the beautiful dwelling of Zion wilt Thou expand; Mount Seir shall be rent; the fixed stake shall be plucked up and removed. God is exalted with a triumphal shout."

This is followed by a hymn composed of the various passages (to be discussed later on) in the Bible, in which the use of the shofar is mentioned. The sounding of the cornet thereupon follows.

The liturgy of the German and Polish Jews contains the ten reasons for sounding the shofar stated by Saadia Gaon.*

Rabbi Saadia observes that God commanded us to sound the cornet as alluding to the following subjects:

First. Because this day is the beginning of the creation on which God created the world and thus began to reign over it; and as it is customary at the coronation of kings to sound the trumpets and cornets to proclaim the commencement of their reign, we, in like manner, publicly proclaim, by the sound of the cornet, that the Creator is our king, and thus says David, "With trumpets and the sound of the cornet shout ye before the Lord."

Second. As the New Year is the first of the ten penitential days, we sound the cornet as a proclamation to admonish all to return and repent, which if they do not, they cannot plead ignorance, as having been fully informed. Thus also we find earthly kings publish their decrees that none may plead ignorance thereof.

Third. To remind us of the law given on Mount Sinai, as it is said. Exodus XIX, 16, "and the voice of the cornet was exceedingly loud," and that we ought to bind ourselves to the performance thereof, as our ancestors did, when they said, "All that the Lord has said, will we do, and be obedient."

Fourth. To remind us of the prophets who are compared to watchmen blowing the trumpets as mentioned in Ezekiel XXXIII, 4, "Whosoever heareth the sound of the cornet and taketh not warning, and the sword cometh and taketh him away, his blood shall be upon his own head, but he that taketh warning shall save his life."

Fifth. To remind us of the destruction of the Holy Temple, and the terrifying alarm of the enemy's warriors shouting to battle as mentioned in Jeremiah IV, 19, "because thou hast heard, oh my soul, the sound of the trumpet, the alarm of war," and therefore, when we hear the sound of the cornet, we ought to beseech the Almighty to rebuild the Holy Temple.

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*Saadia ben Joseph, 892-942, one of the great Jewish scholars of the middle ages. He translated the Bible into Arabic and wrote many important works.

EXPLANATION OF PLATE XCVIII.

SHOFARS.

Fig. 1. * Shofar, of the Great Synagogue, Aldgate, London. (Photograph from Hipkins.)

2. * Shofar, exhibited at Anglo-Jewish exhibition. Supposed to belong to the pre-expulsion period (1290) of the English Jews. (From a photograph.)

3. Shofar, carved and with inscription. (Photographed from Wetzstein's paper.)

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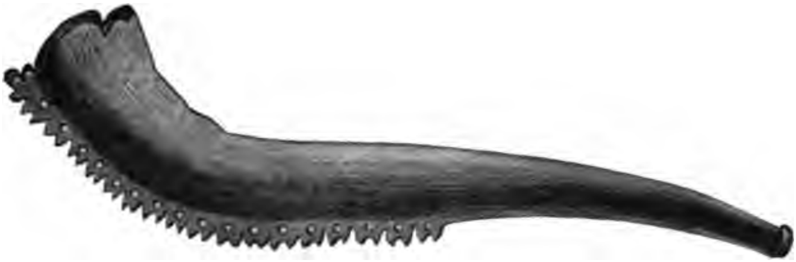
* This figure is illustrated in the catalogue of the Anglo-Jewish exhibition.



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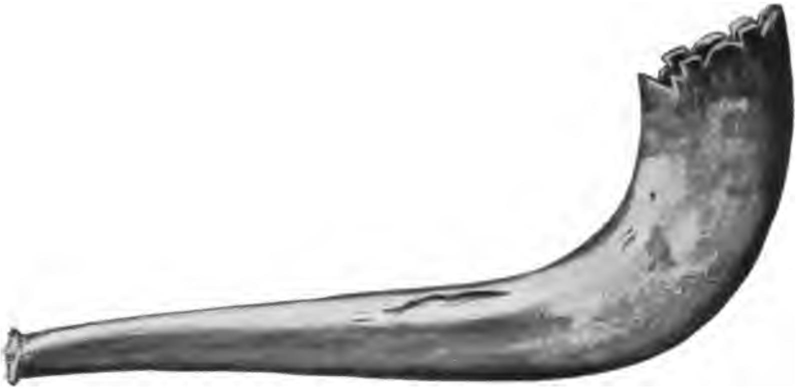

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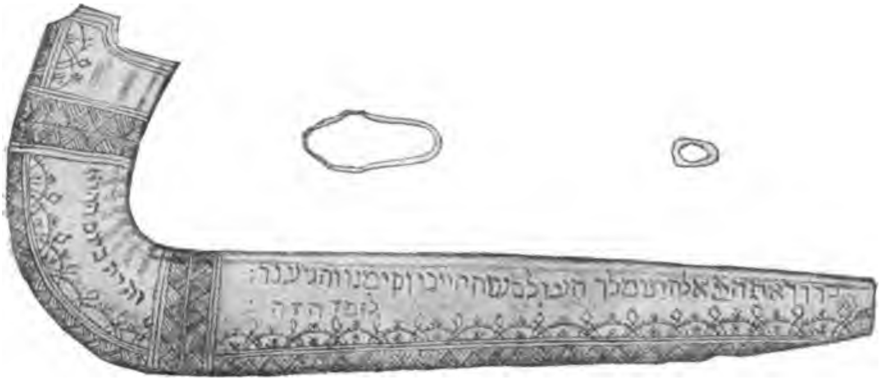

3

SHOFARS.

Sixth. To remind us of the binding of Isaac who willingly submitted himself to the will of Heaven; thus ought we also willingly submit even to death itself, for the sanctification of the unity of His holy name.

Seventh. That when we hear the sounding of the cornet we may, by the dread thereof, be induced to humble ourselves before the Supreme Being, for it is the nature of these martial wind instruments to produce dread and terror. As the prophet Amos observes, "shall a trumpet be blown in a city and the people not be terrified?"

Eighth. To remind us of the great and awful day of judgment on which the trumpet is to be sounded as mentioned, Zephaniah I, 14–16: "The great day of the Lord is near, it is near and hasteneth much, a day of the trumpet and of shouting."

Ninth. To remind us to pray for the time when the outcasts of Israel are to be gathered together, as mentioned, Isaiah XXVII, 13, "and it shall come to pass in that day, the great trumpet shall be sounded and those shall come who were perishing in the land of Assyria."

Tenth. To remind us of the resurrection of the dead and the firm belief thereof, as the prophet Isaiah saith "Yea, all ye that inhabit the world, and that dwell on the earth, when the standard is lifted up on the mountain, ye shall behold when the trumpet is sounded, ye shall hear."

The Biblical passages relating to the trumpet are again employed in the additional service or *Musaf*, which is read on Sabbaths and holidays in place of the additional sacrifice commanded for those days.

In *Mishna Rosh hashana* (IV, 5) minute directions are given as to the nature of the Biblical passages to be employed.

The order of the blessings is as follows: *Aboth* (relating to the forefathers), *qedushath hashem* (relating to the holiness of God), and *geburoth* (relating to the greatness of God), and joined with them are the *malkiyoth* (relating to God as king), and the shofar is not sounded; then come texts concerning the holiness of the day, after which the shofar is sounded; then follow the *zikronoth* (memorials), after which the shofar is again sounded. Next follow the *shofaroth* (relating to the shofar), and the shofar is sounded; he then says *abodah* (worship), *hoda'ah* (thanksgiving) and *birkath kohanim* (the priestly blessing). Such is the opinion of Rabbi Jochanan ben Nourrie; but Rabbi Aqiba objected saying to him: "If the shofar is not to be sounded after the reading of the *malkiyoth* why are they to be mentioned?" But the proper order is the following: *Aboth*, *geburoth*, and *qedushath hashem* are said with which the *malkiyoth* are to be combined; after which the shofar is to be sounded, then the *zikronoth* are to be read, and the shofar sounded; next *shofaroth* and the shofar is again sounded; after which *abodah*, *hoda'ah* and *birkath kohanim* are said. *Mishna Rosh hashana* (IV, 6) provides that no less than ten texts relative to *malkiyoth*, *zikronoth*, and *shofaroth* must be said.

Part of the Bible lesson of the day consists of a recitation of the sacrifice of Isaac, and there is a hymn in the service which dwells on the incident. It is possible that it was sought to establish a basis for the sacredness of the Ram's horn from the fact that it was a ram or *'ayil* which was caught in the thickets by its horns and which served as an offering instead of Isaac. In *Talmud Rosh hashana* we read "Ye shall blow before me with a shofar of a ram, in order that ye may be reminded of the sacrifice of Isaac, the son of Abraham."

The hymn referred to above contains the acrostic Abbas, Judah, Samuel: *i. e.*, Judah ben Samuel ibn Abbas, a poet of the twelfth century, who traveled from Spain to the Orient, and afterward became Rabbi of Fez.*

MISHNIC REGULATIONS.

The Mishna permitted the use of any horn. In *Rosh hashana* III, 3, we read: "Every kind of horn may be used because it is a qeren." Rabbi Jose remarked, are not all shofars called qeren (horn)? (Joshua VI, 6.)

The shofar of New Year's day was usually the straight horn of a ya'al, a kind of antelope or wild goat (chamois), the mouthpiece of which was covered with gold; while the shofar of fast days was a ram's horn whose mouthpiece was covered with silver.

The statute is found in *Mishnah Rosh hashana* III, 3: "The shofar of the New Year was the straight horn of a ya'al, the mouthpiece of which was covered with gold, and two trumpets were placed on either side. The sound of the shofar was prolonged and that of the trumpets made short, because the command of the day is for the shofar; (IV) and on fast days crooked ram's horns were used, whose mouthpieces were covered with silver and two trumpets were stationed between them. The sound of the shofar was made short and that of the trumpets prolonged, because the command of the day is with reference to the trumpets (V). The year of the jubilee is like the New Year with respect to the sounding and the blessings. Rabbi Jehudah, on the contrary, says: "On New Year they sound with the horns of rams, and at the Jubilee with chamois."

The instrument used in the modern synagoge has no adornments. It probably represents a more ancient form than the instrument described in the Mishna.

A shofar, which had been broken and joined together could not be employed, though its use was admissible, if it contained a hole which had been closed so as not to interfere with the sound.†

In the modern synagogue the shofar is not sounded on New Year's day when it occurs on the Sabbath. This seems to have been the

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* Karpeles, *Geschichte der Judischen Literatur*, p. 496.

† "It is unlawful to use a shofar which had been rent and afterwards joined together; also one composed of several pieces joined together. If a shofar had a hole which had been closed, if it hinders the proper sound, it may not be used; but if it does not affect the proper sound it may be used."—*Mishna Rosh hashana,* III, 6.

EXPLANATION OF PLATE XCIX.*

SHOFARS.

Fig. 1. Shofar of the eighteenth century, from Bagdad. Exhibited at the Anglo-Jewish exhibition. (Enlarged from a photograph.)

2. Shofar exhibited at the Anglo-Jewish exhibition. (Enlarged from a photograph.)

3. Shofar (black from age) belonging to the Great Synagogue, London. Exhibited at the Anglo-Jewish exhibition. (From a photograph.)

4. Shofar exhibited at the Anglo-Jewish exhibition. (Enlarged from a photograph.)

5. Shofar used by the Bene-Israel, a colony of Jews settled in Bombay and neighborhood. It was brought from Aden, and is said to be made of the horn of an animal called the "cudoo." Exhibited at the Anglo-Jewish exhibition. (Enlarged from a photograph.)

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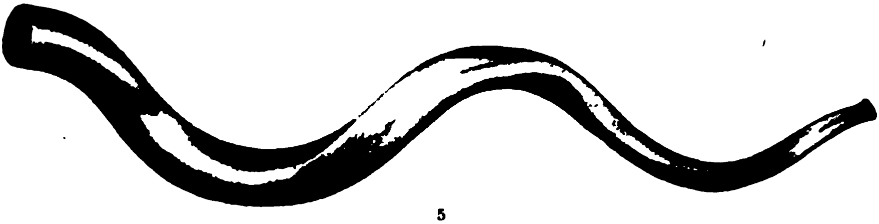
* These figures are illustrated in the catalogue of the Anglo-Jewish exhibition.



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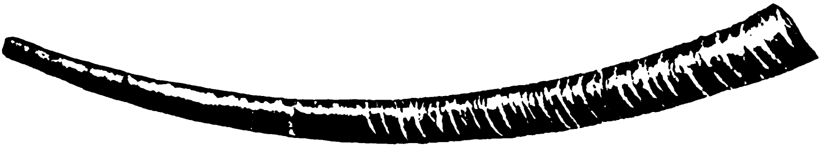

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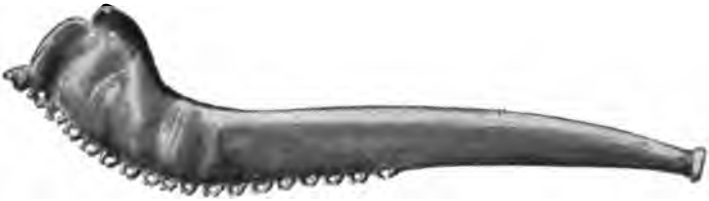

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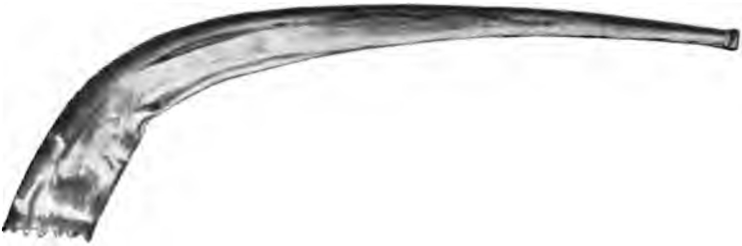

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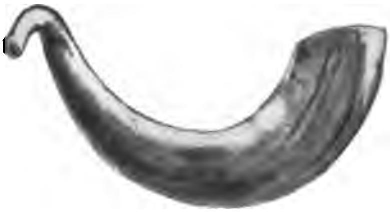

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SHOFARS.

ancient rule after the destruction of the temple, though it was subject to some modification.*

Mishna Rosh hashana, IV, provides that some person other than the reader of the prayers shall sound the shofar.†

BIBLICAL PASSAGES.

We will now proceed to examine the biblical passages with reference to the shofar. Its use for religious exercise is prefaced by the presence of its sound at the giving of the law. (Exodus, XIX, 19; XX, 18.)

It is mentioned with other instruments as a fitting announcement of the new moon. The solemn feasts were similarly announced. New Year's day was a "memorial of blowing," though it will be noticed that the passages in the Pentateuch which refer to this day, both use the word "*teru'ah*," or blowing, without expressly mentioning the shofar itself.

"Speak to the children of Israel as follows: In the seventh month, on the first day of the month, there shall be to you a Sabbath, a memorial of blowing, a holy convocation" (Lev., XXIII, 24), while in another passage it is simply called "a day of blowing" (Numbers, XXIX, 1).

Special feasts or solemn assemblies for particular purposes were announced by the blowing of the shofar. (Joel, II, 15.)

The great year of release, which occurred after the enumeration of seven times seven years, was announced by the sounding of the shofar, not at the beginning of the year, on New Year's day, as might be expected, but ten days thereafter, on the Day of Atonement. (Leviticus, XXV, 9.)

In Isaiah's vision of the great day of judgment the shofar is blown to assemble "those who are lost in the land of Asshur and those who are outcasts in the land of Egypt." (XXVII, 13.)

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* "When the feast of the New Year happened on the Sabbath they used to sound the shofar in the sanctuary, but not out of it. After the destruction of the temple, Rabban Jochanan, son of Zaccai, ordained that they should sound (on the Sabbath) in every place where there is a tribunal of justice (*Beth Din*). Rabbi Eleazar says: "He only issued this order in respect to Jamnia," but they (the other sages) said unto him, "it was the same for Jamnia as for any other place in which there is a permanent tribunal of justice."

"And in this respect also was Jerusalem privileged above Jamnia, viz, that every city from whence Jerusalem could be seen and the sounding heard, which was near enough, and to which it was allowed to go on the Sabbath, might sound; but in Jamnia it was only permitted to sound before the tribunal of justice.—*Mishna Rosh hashana*, IV, 2.

† "It was not permitted for the purpose of sounding the shofar on the feast of New Year, to go beyond the Sabbatical limits, to remove a heap of stones under which a shofar is buried, mount a tree, ride on any animal, or swim over the waters to get a shofar, nor may he cut it with anything that may not be used, on account of transgression against the Sabbatical rest, nor disobey on its account any negative precept of the law; but a person may, if he choose, pour water or wine into the shofar to improve its sound. Children should not be prevented from sounding, but on the contrary it is lawful to be occupied in teaching them to sound."—*Mishna Rosh hashana*, IV, 8.

When David removed the ark to Jerusalem the sound of the shofar was heard in the procession. (II Samuel, VI, 15; I Chron., XV, 28.)

It is mentioned along with other musical instruments as a proper accompaniment of psalmody. "Praise Him with the blowing of the shofar, praise Him with the psaltry and the harp." (Ps., CL, 3; cf. also XCVIII, 6.)

Some years ago I was informed it had been introduced into opera by an Italian composer, with what success I do not know.

WAR HORN.

The most ancient use of signals of any sort was no doubt to apprise a tribe of the coming of an enemy and to call together the clansmen for defense. Possibly the earliest, certainly the most frequent use of the shofar in Israel, was for military purposes.

The ancient Egyptians used a trumpet for military purposes, but it was a long, straight metallic instrument like the Hebrew *haçoçera*. (Wilkinson, I, 104f.)

The troops seemed to have marched to its notes. (*Ibid.*, woodcut 289, and Rawlinson, History of Ancient Egypt, Vol. I, p. 491.)

The shofar could be heard at a great distance. There is an allusion to its loudness in Isaiah (LVIII, 1): "Cry with a full throat, spare not, like the shofar lift up thy voice, and declare unto my people their transgression, and to the house of Jacob their sins."

It played an important part in the imposing demonstration made before the walls of Jericho. (Joshua, VI, 4, 5, 6, 8, 9, 13, 16, 20.)

When Gideon was filled with the spirit of the Lord he assembled the outlaws who composed his army by blowing the shofar (Judges VI, 34). Each man carried one of the instruments and the noise thereof very materially contributed to the surprise of the Midianite army. (Judges, VII, 8, 16, 18, 19, 20, 22.)

In the actual narrative itself, the shofar is not as frequently mentioned as the constancy of its use for certain purposes might lead us to expect. The infrequency of its mention is in a way, however, a sort of evidence of the frequency of its use. The blowing of the bugle is as regular a part of a charge as the horses on which the cavalry is mounted. Its picturesqueness would naturally strike the mind of a poet and so the references to the shofar in the prophetical books are numerous.

In the following nineteen passages from the prophets, the shofar symbolizes war:

"Tell ye in Judah, and publish in Jerusalem, and say, Blow ye the shofar in the land: call out, gather together, and say, Assemble yourselves, and let us go into the fortified cities." (Jeremiah, IV, 5.)

"My bowels, my bowels! I am shaken, at the very chambers of my

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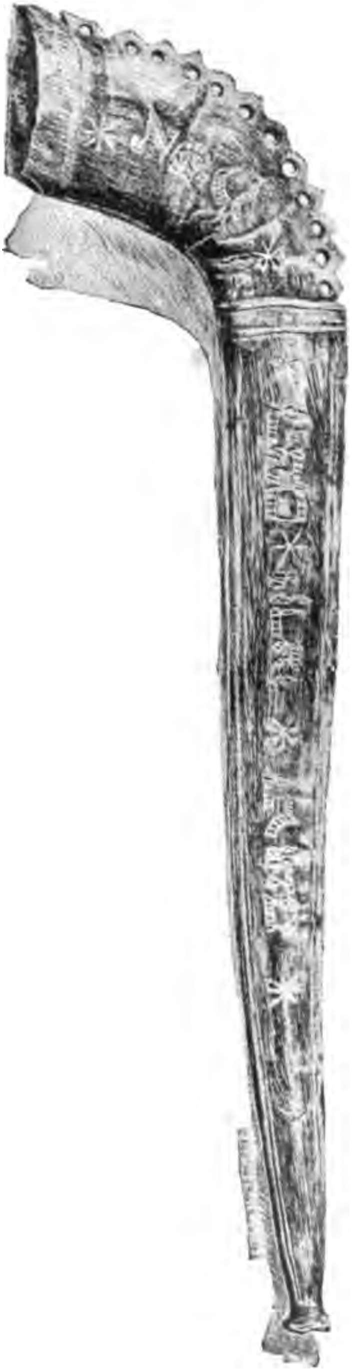
EXPLANATION OF PLATE C.

SHOFARS.

Fig. 1. Shofar in possession of Miss Elizabeth F. Aaron, New York. (From a ph graph of the original drawing, through the courtesy of the Century C pany, New York.)

2. Shofar belonging to the Great Synagogue, London. Exhibited at t Anglo-Jewish exhibition. (From a photograph.) (Inscribed.)



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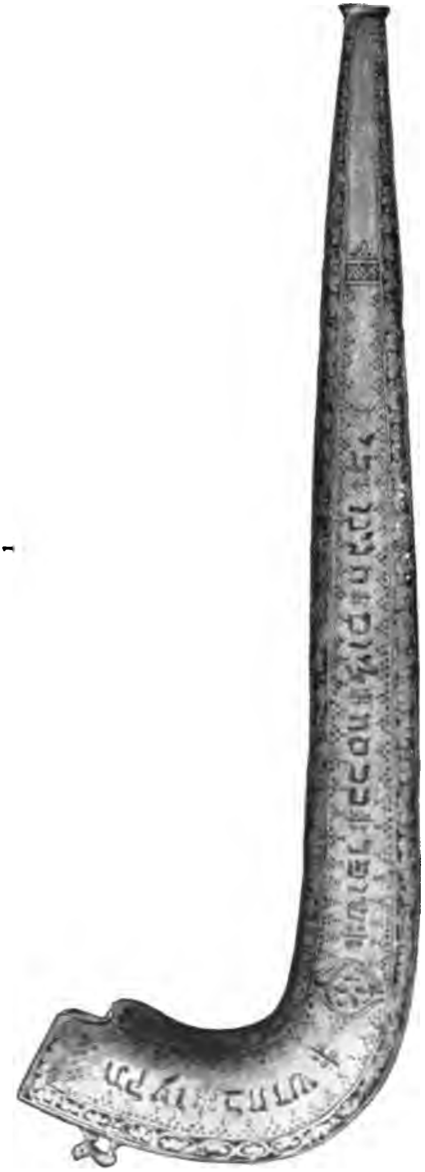

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SHOFARS.

heart; my heart beateth tumultuously in me; I can not remain silent; because the sound of the shofar hast thou heard, O my soul, the alarm of war." (Jeremiah, IV, 19.)

"How long shall I see the standard, hear the sound of the shofar?" (Jeremiah, IV, 21.)

"Assemble, O ye children of Benjamin, to flee out of the midst of Jerusalem, and in Thekoa, blow the shofar and on Bethhakkerem set set up a fire signal; for evil is seen (coming) out of the north, and great havoc." (Jeremiah, VI, 1.)

"Then did I set watchmen over you, (saying) Listen to the sound of the shofar. But they said, We will not listen." (Jeremiah, VI, 17.)

"Saying, No; but into the land of Egypt will we go, that we may not see war, nor hear the sound of the shofar, and that we may not have hunger for bread; and there will we dwell." (Jeremiah, XLII, 14.)

"Lift ye up a standard in the land, blow ye the shofar among the nations." (Jeremiah, LI, 27.)

"And if he see the sword coming over the land, and blow the shofar and warn the people." (Ezekiel, XXXIII, 3.)

"And whosoever heareth the sound of the shofar and taketh no warning; and the sword cometh, and taketh him away, his blood shall be upon his own head." (Ezekiel, XXXIII, 4.)

"The sound of the shofar hath he heard, and he hath taken no warning; his blood shall be upon him. But had he taken warning he would have delivered his soul." (Ezekiel, XXXIII, 5.)

"But if the watchman see the sword coming, and blow not the shofar so that the people be not warned, and the sword cometh, and taketh away from among them some person, this one is taken away for his iniquity; but his blood will I require from the watchman's hand. (Ezekiel, XXXIII, 6.)

'Blow ye the shofar in Gib'ah, the trumpet in Ramah; blow the alarm Beth-aven. (The enemy is) after thee, O Benjamin." (Hosea, V, 8.)

"Set the shofar to thy mouth. (Let the enemy come) like the eagle against the house of the Lord; because they have transgressed my enant, and against my law have they trespassed." (Hosea, VIII, 1.)

"Blow ye the shofar in Zion, and sound an alarm on my Holy Mount; et all the inhabitants of the land tremble; for the day of the Lord ometh, for it is nigh." (Joel, II, 1.)

"And I will send a fire against Moab, which shall devour the palaces f Keriyoth; and Moab shall die in the tumult, in the shouting, amidst sound of the shofar." (Amos, II, 2.)

Shall a shofar be blown in a city and the people not become afraid? re be evil in a city, and the Lord have not done it." (Amos,

day of the shofar and alarm, against the fenced cities, and inst the high battlements." (Zephaniah, I, 16.)

"With impatient noise and rage he holloweth (with his hoof) the ground, and keepeth not quiet when the shofar's voice (is heard)." (Job, XXXIX, 24.)

OTHER USES.

From the Talmud we learn that the use of the shofar as a note of alarm of war was transferred to other seasons of danger and distress. Famine, plague of locusts, and drought (Mishna Taanith, I, 6) occasioned the blowing of the shofar.

The shofar was employed at the public ceremony of excommunication.* (Wetzstein, p. 67.)

A very curious use of the shofar in later times was in funeral ceremonies (Wetzstein, p. 67). I agree with Wetzstein that this use of the instrument is quite apart from the usual Semitic custom and was probably borrowed.

As a signal instrument of war it had various uses, possibly according to the note that was blown. It was the signal for going out to battle, for the announcement of a victory, and for a recall of the troops.

It was with the shofar that Ehud assembled the people. "And it came to pass, when he was come, that he blew the shofar on the mountain of Ephraim, and the children of Israel went down with him from the mountain and he before them." (Judges, III, 27.)

"And again there happened to be a worthless man, whose name was Sheba, the son of Bichri, a Benjamite, and he blew the shofar and said, 'We have no part in David, nor have we any inheritance in the son of Jesse; every man to his tents, O Israel.'" (II Samuel, XX, 1.)

Isaiah refers to this use (XVIII, 3):† "All ye inhabitants of the world, and dwellers on the earth, when the ensign is lifted upon the mountains, see ye; and when the shofar is blown, hear ye."

When Jonathan had defeated the Philistines in Geba, "Saul blew the shofar throughout all the land, saying, Let the Hebrews hear," (I Samuel XIII, 3,), and thus become acquainted with the victory.

It announced the end of the struggle between Abner and Joab which succeeded the death of Saul. (II Samuel, II, 28.)

After the death of Absalom, which really ended the revolt against David, Joab blew the shofar and the people returned from pursuing after Israel. (II Samuel, XVIII, 16, *cf.* also II Samuel, XX, 22.)

The shofar was employed to announce the coronation of a king. This may be considered but a feature of its use for military purposes, since, as some of the passages about to be quoted show, the coronation

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*In *Sanhedrin*, 7 b., we read: "Rab Huna when about to hold court was accustomed to ask for the implements of his trade: a rod, a strap, a shofar, and a sandal." The shofar, remarks Rashi, was for use at an excommunication.

†Nakáreh Khâneh, a rock near Bandamir, in Persia, is so called (according to tradition) because at the sound of drums and trumpets the workmen engaged on the walls and dikes in the neighborhood assembled there to receive their wages and provision. (Ousely, II, 186.)

of the king and the announcement of his victory over some other tribe or faction were one and the same event.

When Absalom was engaged in the revolt against his father he sent spies among all the tribes of Israel announcing his intentions and informing them that when they heard the shofar sounded they might say that he had become king. (II Samuel xv, 10.)

In the directions given with regard to the coronation of Solomon the use of the shofar is expressly mentioned (I Kings, I, 34 and 39), and its sound affrighted Adonijah and guests at their banquet. (I Kings, I, 41.)

The overthrow of the house of Ahab and the coronation of Jehu were proclaimed in the same way. (II Kings, IX, 13.)

ETYMOLOGY.

The etymology of shofar is not at all clear. Gesenius derived it from the stem *shafar* "to be bright, clear, beautiful—possibly on account of its clear sound," but this is hardly satisfactory. The editors of the eleventh edition of Gesenius retain the same explanation.*

Nothing can be learned from Arabic *šabbûr*.† This is simply borrowed from the Talmudic form *šippûra* or *šippûr*, the b in Arabic representing the Hebrew p, as the Arabic possesses no p, but only f.‡

The trumpet now used by the Arabs of Asia Minor, which they call *šeifur*, is a metallic instrument. It is possible, however, that the word was originally applied by the Arabs to an instrument of horn.§

The Arabian Jews called the shofar *šaafar*. We may, however, get some light from Assyrian. ||

According to Stade (Grammar, par. 218*a*) the Hebrew shofar stands for a form *sappar*, and exactly this form has been found in Assyrian. In a cuneiform list of animals (II Rawlinson, VI, 6 cd) we find, following *atûdu*, "he goat," the word *šapparu*, which is accordingly the name of an animal, possibly of the goat order. The word also occurs in a

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*They say parenthetically that the shofar was the shape of a horn and *possibly* made of horn.

†Wetzstein, p. 73, proposes an Arabic etymology; *šufra* and *šafîr* in Arabic mean edge or corner, and it is probably his idea that they bear the same relation to shofar that corner bears to Latin *cornu*. The late Prof. de Lagarde compared shofar with Armenian *shifora* (*Armenische Studien*, p. 117, No. 16931).

‡*Cf.* Siegmund Fraenkel, *Die Aramaischen Fremdworter im Arabischen*, Leyden, 1888, p. 24.

§ See Musical Instruments and their Homes, by Mary E. Brown and William Adams Brown (New York, 1888), p. 196. It is principally interesting because it resembles the trumpet played by an Assyrian warrior on a bas-relief of Nineveh and the Hebrew trumpet represented on the arch of Titus at Rome. This latter is not identical with the shofar; it is the straight metallic trumpet or *haçoçera* which is represented on the arch of Titus (Engel, p. 24).

|| Fr. Delitzsch, *Prolegomena eines neuen Hebraisch-Aramaischen Worterbuches zum Alten Testament*, Leipzig, 1886, p. 125.

bilingual incantation (V Rawlinson, 50, 47–49*b*) describing the action of the disease called *asakku*. The passage reads: *turâha ina qaqqadišu u qarnišu iççabit, atûda šappar šadî šappartašunu iççabit,* "the mountain goat by its head and horns it seizes, the he goat, the šappar of the mountain, by its šappartu it seizes." Here *šappartu* undoubtedly means "horn," being the feminine form used in Semitic to denote lifeless objects (Gesenius, Grammar, par. 107, 3, *a*); the conclusion would, therefore, be that the shofar is so called because it was originally made of the horn of the species of goat called *šappar*.* The Hebrew shofar corresponds to Assyrian *šappartu*, it being worthy of notice that shofar, although not possessing the feminine termination in the singular, always makes a feminine plural.

In the discussion on the Wetzstein paper Mr. Hartmann suggested that the peculiar shape of the horn given to it artificially was intended to imitate the shape of the horn of some wild animal, possibly the wild sheep (*Ovis cyprias*); not that I apprehend that the suggestion is exactly correct, since, as will be seen, the shape is not uniform. The suggestion, however, that the horn was not that of a domesticated animal, but of an animal more difficult to get, seems to have a certain inherent probability.

Wetzstein is of the opinion that the use of the ram's horn may have been borrowed by the Israelites and goes back to a people who were engaged solely in the care of sheep. By these it was used as a signal of alarm.

SIMILAR INSTRUMENTS.

Various ancient and modern nations have used the horns of animals for wind instruments. The following specimens are preserved in the collection of musical instruments in the U. S. National Museum.

At the time of the Festival of the Prophet the Berbers use a horn which consists of two rams' horns joined at the ends and provided with metal mouth-pieces. This instrument is now called zamr. The specimen belongs to the National Museum and was collected by Mr. Talcott Williams.

The Shringa, "an ancient outdoor wind instrument of the horn species. It is commonly known as the Indian horn. It was the favorite instrument of the Hindu god Siva." It is a common ox or buffalo horn of dark color, scraped and polished, the tip cut off and the embouchure enlarged and shaped with a hot iron. It is 12½ inches in length and the diameter varies from five-eighths to 2½ inches. In form it differs in nowise from the shofar. (Pl. XCVII, Fig. 4.)

The *Embuchi*, also known as the *Ponza*, *Apunza*, and *Oukpwe*, an African trumpet or war horn made of an elephant's tusk, the natural cavity forming the bore of the horn. (Pl. XCVII, Fig. 10.) The embouchure is formed on the inner or concave side of the tusk, the ivory being worked away so as to leave a projecting mouthpiece 3⅝ inches long, 1½ inches wide and one-half inch high. The instrument itself is 21½ inches long; the diameter tapers from 3¼ by 3⅝ to three-fourths of an inch. It is made by the Palla Balla negroes of the Lower Congo.

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*Baron von Korff, in the discussion of Wetzstein's paper, asserted that the goat horn was still used for making shofars by the Jews of Poland. If this statement be correct it would point to a tradition more ancient than that contained in the Jewish liturgy.

African war horn made of elephant's tusk, rudely carved about the mouth hole and smaller end. It is suspended by a cord of human hair sennit. The natural cavity forms the bore of the horn. The embouchure is made in the concave side of the horn and is elliptic in shape. The instrument is 20 inches long, the diameter of the bell being 3½ inches. There are four other war horns of elephant's tusks, made in various parts of Africa, which do not differ in form from the specimens described above.

The natives of Sumatra use a trumpet made of the horn of a cow.*

The earliest metal trumpets were constructed on the same principle as the shofar, and in some cases the form of the instrument is plainly a copy of some natural horn.†

In one of the smaller mounds at Tello, M. de Sarzec discovered a fragment of a large bronze statue. "It was," he says, "a life-sized bull's horn of bronze plating, mounted on a wooden frame, but the wood was carbonized by the action of fire."

There is a Siamese engraved copper horn in the U. S. National Museum shaped like a buffalo horn. (Pl. XCVII, Fig. 5.) The British Museum possesses a bronze Etruscan cornu (engraved), constructed on the same principle (Engel, p. 33). Of similar pattern was the tuba. Both the cornu and the tuba were employed in war to convey signals (*ibid.*, p. 36).

The Greeks had a curved horn, *keras*, made of brass, and a straight horn, *salpinx*, exclusively used in war (*ibid.*, p. 32). Trumpets are often mentioned by writers who have recorded the manners and customs of the Indians at the time of the discovery of America (*ibid.*, p. 67). No specimen of such trumpets have so far been discovered among North American aboriginal remains. A wooden wind instrument is in use among the Carvadoo, an Indian tribe in Brazil. "With this people it is the custom for the chief to give on his war trumpet the signal for battle, and to continue blowing as long as he wishes the battle to last" (*ibid.*, p. 69).

The metallic descendant of the Indian buffalo horn, the *shringa*, mentioned above, is the *rana shringa*, an outdoor instrument made of copper, formerly used in military and now universally in religious processions throughout India, both by Hindus and Mohammedans, the performers usually being Hindus of the lower caste. In the villages of southern and central India the watchmen blow it at sunset and at certain hours of the night, like the German *nachtwächter*. In large cities a horn-blower is always attached to the police. There is seldom a guard or detachment of native irregular troops without one. It is employed in all processions, temple services, marriages, and other festive occasions, and at funerals.*

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* *Indonesien, oder die Inseln des malayischen Archipel, von* A. Bastian. III. *Lieferung. Sumatra und Nachbarschaft.* Berlin, 1886, Pl. II, No. 5.

† Babelon: *Manual of Oriental Antiquities*, p. 37; *Revue archéologique*, 1883 (3ᵉ série, t. II), Pl. XX.

Another trumpet of the same class is the kurna, used chiefly in religious processions, or in festivals in honor of local divinities. Only Brahmins and persons of a certain rank are permitted to use the kurna. It is esteemed by all Brahmins to be the most ancient instrument of music in existence, and the sound of it to be especially pleasing to the gods in various particular ceremonies and at solemn parts of the sacrifices (Cf. Ibid. loc. cit.).

CONCLUSIONS.

In conclusion, the following deductions, which seem to be legitimate, are drawn, though all are not advanced with equal confidence:

(1) The oldest wind instrument used by inland peoples was the horn of an animal, with a natural cavity, and a mouthpiece formed by cutting off the end. Horns which required hollowing came later into use.

(2) These horns were originally used as signals in time of danger and for making announcements in general.

(3) Many of these important announcements had a religious character. The antiquity of the instrument caused its permanent adoption for sacred purposes.

(4) The shofar, speaking especially of the instrument of that name, was originally a wind instrument, made of the horn of a wild goat. Its sacred character may be connected with sacrificial use made of the goat.

(5) The etymology of the word is to be sought in the Assyrian *šappar*, a species of wild goat; *šappartu* (the feminine form) meant originally the horn of the sappar, and it may afterwards have been used for horn in general.

Tribes dwelling near the sea used shells for the same purpose. Biblical Hebrew possesses two other words for the horn of some special animal, *qeren* and *yobel*, which were originally applied to animals. It is interesting in this connection that Hebrew qeren, Latin cornu, and English horn are all used both for a wind instrument and for the horn of an animal.

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* *Cf.* Capt. Meadows Taylor. Proceedings of the Royal Irish Academy, Vol. IX, Pl. 1, p. 110.

THE CRUMP BURIAL CAVE.

(BLOUNT COUNTY, ALABAMA.)

By FRANK BURNS, *U. S. Geological Survey.*

This cave was discovered in the summer of 1840, by Mr. James Newman and some of his friends while hunting. It is located on the banks of the southern branch of the Warrior River, in Murpheys Valley, Blount county, Alabama, and is in the steep limestone cliffs where the river entered a gorge and left the valley. The entrance to the cave was about 400 feet above the stream and 50 feet below the plateau above. The opening into the cave was so small that a man could scarcely crawl into it. Procuring lights, the hunters entered the cave. They found it perfectly dry, the air pleasant and cool, and the rooms sufficiently large to accommodate the rather large party of young men. A short distance from the entrance was a room, which proved to be a "burial cave" of the aborigines. They found eight or ten wooden coffins of black and white walnut, hollowed or cut out of the solid, after the fashion of the "dugout" canoe. The coffins were sent to the Smithsonian Institution, where they have been restored as far as possible, and are now exhibited in the department of prehistoric anthropology. Eight have been restored, and there are in addition many parts of coffins. The coffins are about 7½ feet long, 14 to 18 inches wide, 2½ inches thick, and 6 or 7 inches deep. They have been hollowed out by fire, aided by stone or copper chisels, or hatchets. Traces of the use of both implements are to be seen on the inside. The ends are open, as shown in Fig. 1 of the accompanying plate. (Pl. CI.)

In proximity to the coffins were twelve or fifteen human skulls, and also a large number of human bones. These were scattered around, showing that there had been disturbance after burial, whether by beasts of prey or otherwise could not be determined. If there were bones of other animals, it was not observed or not reported.

There were five or six wooden trays—one was secured and sent to the Smithsonian Institution. It is 18 inches long, 12 inches wide, 1½ inches thick at the bottom, reduced to thin edges at the top, and 3 inches deep. Also six small wooden bowls, a fragment of one only being secured. Scattered about, but near the skeletons and coffins, were found the following objects: About 200 pounds of galena, some of the larger pieces being rudely grooved, similar to the aboriginal stone axes and mauls, as though for warclubs—*casse-tetes;* a number of arrow and spear heads and other relics; a small copper hatchet, a copper chisel about 5 inches long, and about twenty copper ornaments, most of these having small holes drilled as though for suspension; six or seven large shells (*Fulgar carica*); some shell disks and beads and pieces of wooden matting about 6 inches square, made of bark or cane and much decayed. One of the copper chisels and some of the galena were in one of the coffins.

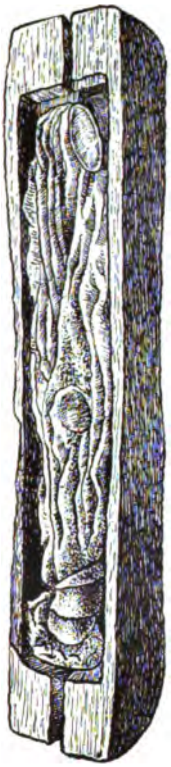
The opening of the cave was enlarged, and became a place of some celebrity, being visited by the citizens, neighbors, guests, etc., who carried away such things as suited their fancy. The skulls were carried away by doctors, and the beads were appropriated by the children, while others broke up the galena and carried it away for the purpose of making bullets.

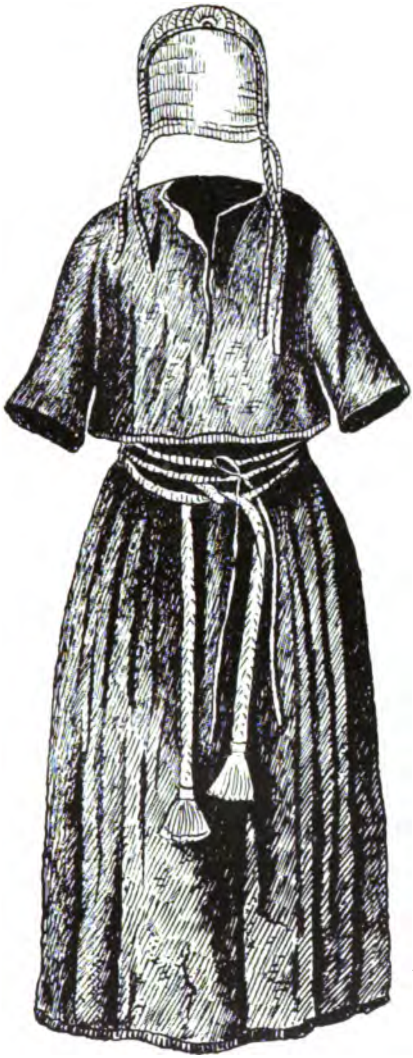
The cave remained in this condition for twenty or more years. During the war for the suppression of the rebellion, the cave was excavated for saltpeter, and was also a hiding-place for refugees. The coffins were badly damaged, as is shown by their present condition, but fortunately were not destroyed. How they could have escaped use as firewood is scarcely imaginable.

The late Rev. William Crump owned the land on which the cave was situated, and from whom it takes its name, and his family still owns it. They had in their possession a few years ago, a number of copper objects, a few stone implements, and two of the large shells, one of which was used at the blacksmith shop for pouring water on hot iron. I made effort to obtain these relics, but failed. They permitted me to visit the cave and collect the coffins and pieces there, which I hauled a distance of 30 miles to the railroad, and shipped them to the National Museum. I spent some time on different occasions in visiting this cave and talking to Mr. James Newman and others who discovered the cave, and obtained from them the facts which I have here recorded and which I regard in every way as reliable. That the cave was a very old burial place is undeniable.

There is a small mound at the foot of the bluff in the narrow river bottom, and around it a number of relics have been plowed up, one of which was a "stone wheel" with a groove around it, probably used as part of a machine for drilling holes in stone and copper.

About five miles north of the Crump Cave, on the mountain of limestone just beneath the overhanging cliff of Millstone Grit, I found and forwarded to the Museum an Indian ladder which stood against the precipice and had been used to mount or climb up to what the people call a "rock house," *i. e.*, a large, roomy, dry place under overhanging cliffs of stone, probably used like the cave, for burial purposes. This ladder is the trunk of a cedar tree about 8 inches in diameter, is about





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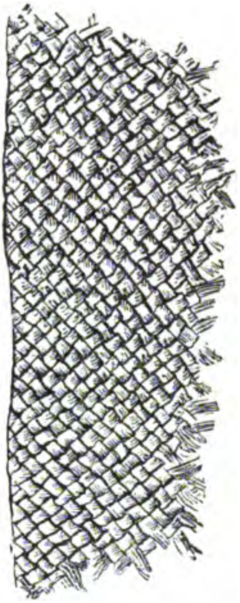

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OBJECTS ILLUSTRATING PREHISTORIC BURIALS. (Bronze age.)

Fig. 1. Hollowed oak coffin, containing skeleton of a man. (Treenhoi, Denmark.)
Fig. 2. Woman's woolen dress found in oak coffin. (Borum-Eshoi, Denmark.)
Fig. 3. Detail of woman's woolen dress. (Denmark.) A similar specimen in the U. S. National Museum. (Cat. No. 136615.)

14 feet long, has 7 or 8 steps, 18 or 19 inches apart, made by cutting nto the tree a scarf about 6 inches high and 2 inches deep. Near the foot of the ladder, but out in the open air, was a rock mound of good size, from which some relics had been dug by parties hunting for buried Indian money.

There are many such houses in the coal measures, and they were used by the aborigines as dwelling or burial places. I have found human bones, and in one instance some beautiful arrow-heads, in a number of such places among the mountains. The aborigines would lay their dead away in rock crevices in wild and retired spots, and cover them with stones enough to protect them from wild animals and leave them in the "Eternal Silence." I have in some instances sent the bones to the Museum; in other cases I left them undisturbed. I have walked many miles for the purpose of making similar investigations through the country formerly belonging to the Creeks or Muscogees, when it was impossible to ride and dangerous even to walk.

In the year 1881 I visited the site of a former Creek Indian village in Brown's Valley, Marshall County, Ala. This was a village of friendly Creeks. They had helped Gen. Jackson in the war against their countrymen, and after peace was made, he removed and settled them on lands of the Cherokees until they were sent west of the Mississippi. The early settlers told me that when one of the Creeks died, they buried him in a corner of one of the huts or wigwams, which in this village were small houses made of logs after the manner of the white settlers, and that when a person was buried in each corner of a hut, it was pulled down and removed to another spot. I had no means of verifying this report. In the Cherokee country they buried their dead in caves in some instances, but generally in the ground, like Americans.

Remarks by Mr. Thomas Wilson.—While this method of coffin burial was unusual, if not unknown in the United States, yet there were similar burials among the prehistoric peoples of other countries. In the center of one of the display rooms in the great Prehistoric Museum at Copenhagen stand two coffins, similar in appearance to those just described, made of the cloven and hollowed trunk of an oak tree (Pl. ci, Fig. 2). One came from Treenhoi and the other from Borum-Eshoi, Denmark. One contained the body of a man; the other that of a woman. The skeleton of the man had crumbled away; that of the woman was well preserved. From the remains of the clothing they have been able to reconstruct the garment of that period (Pl. ci, Fig. 3). The material was wool, which had been closely spun, and was of the color known in the United States as "butternut"; whether that was the original color, or whether it had been changed by contact with the oak coffin, was not determinable. The garments consisted of a high cap, a wide, roundly cut mantle, a sort of tunic, pieces of wool which had probably covered the legs, while at the feet were remains of leather or skin, which had possibly been shoes. The cap was without a visor, and it and the garment were covered with a projecting knotted thread, which hung down. The tunic was kept together with a long woolen belt, which went twice around the waist, was knotted in front, and the two long ends hanging down were decorated with fringe. At his left side lay a bronze sword in a wooden sheath lined with skin. At the foot was a round wooden box containing a smaller box of the same kind, which, in its turn, contained an extra woolen cap, a horn comb, and a bronze razor. The bodies in both burials were wrapped in cow-hide. The woman's coffin contained a bronze fibula, or safety pin, a bronze dagger with a horn handle, a spiral finger ring, two bracelets, a torque, and three round and beautifully decorated bronze belt plates of different sizes, with points projecting in the middle.

There is in the National Museum a square of the same cloth from a similar burial, obtained by myself at Frederichsund, a detail of which, the fiber and mode of weaving, can be seen as shown in Fig. 3 of the plate. In these cases the coffins were different from those at Crump's Burial Cave, the corresponding upper half of the tree trunk having been hollowed out and serving as a coffin lid.

The *London Chronicle* (1767) reports the opening of a mound (barrow) near Wareham, Dorsetshire, wherein was found a human burial in the hollowed trunk of an oak tree. The bones were wrapped in a covering of deer skins sewn together. And here was found what was considered a piece of gold lace wrought into lozenge pattern. (Mrs. Bury Pallister, *History of Lace*, p. 3.)]

MINUTE STONE IMPLEMENTS FROM INDIA.

By Thomas Wilson, *Curator of Prehistoric Anthropology.*

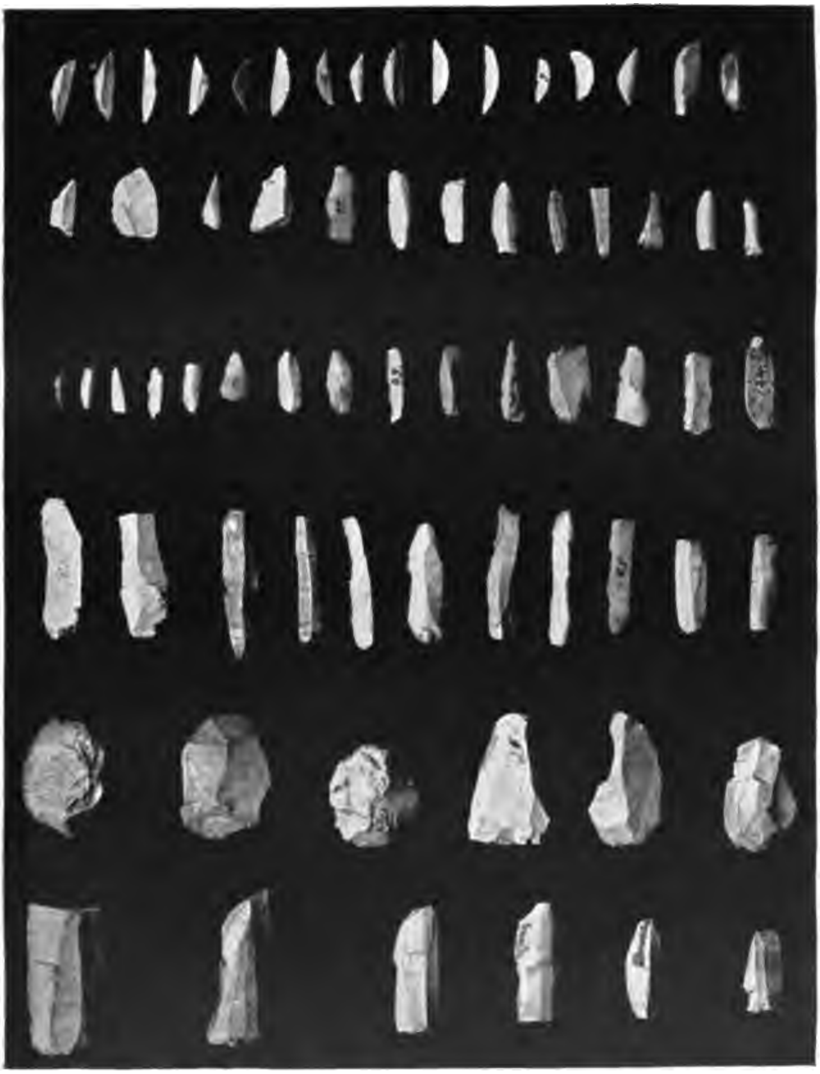
The National Museum has become possessed of an extensive series of minute chipped stone implements from India. They were collected by Mr. A. C. Carlyle, formerly of the Archæologic Survey, in the Vindhya hills or mountains in central and north-western India. They were obtained through the assistance of Mr. Charles Seidler, of London. The series comprises every condition of the implement, from the rude material, the nucleus or core, the flake—sometimes rude, often quite symmetrical—and so on through the various steps, until is reached the finished chipped implement of every form. Their peculiarity, differing from other prehistoric implements, is their remarkably small size. The cores themselves are rarely more than an inch and three-quarters in length, and the blades are rarely more than an inch and a quarter or an inch and a half—the majority of them are not more than an inch, while the finished specimen is frequently not more than five-eighths of an inch in length. Needless to say that all these flakes are of extreme thinness. The finished implements are of various forms—slim, almost needle-like, triangular, with a base, convex, straight or concave, quadrilateral, trapezoid, rhomboidal; while the most delicate and finely finished are in the form of a crescent.

These various shapes are indicated in the figures on the accompanying plates, and the numbers of each kind belonging to the collection will be given in the list at the end of this paper. Plate CII represents some of the implements by photograph. There is a marked difference between the two edges of the crescents. The crescent edge is thick and has been worked in to its present shape by the secondary chipping of the most minute kind, while the straight edge is the cutting edge, sharp and thin, just as it comes from the nucleus, and is without any secondary chipping. The material comprises all the variety of silicious rock jasper, chert, horn-stone, flint, agate, and chalcedony; some of them are rare and fine specimens. They belong to the neolithic period, although they are something new to its culture. The whole series bears the same impress. The similarity of form and mode of manufacture, and their being found in the same general locality, is evidence showing the same intention on the part of the makers, although we are quite in the dark as to what that intention was. All varieties of small implements were found by Mr. Carlyle in the caves and rock-shelters among the Vindhya hills in places difficult of access and unknown to the ordinary traveler. Some of them were found in the alluvium at the mouth of the cave, where they had been washed out and were caught in slight ledges of the rock, after the fashion of washed gold in the rocking-cradle. Within the caves they were found in the upper strata, while immediately beneath, but separated from them, were larger implements, different in size, kind, and style, and formed of indurated sandstone, hematite and chert. Crescent implements were found in grave mounds in the neighborhood of the caves, leading one to suppose that the inhabitants of the caves who made these implements built the mounds and here buried their dead. Mr. Carlyle, while agreeing that these implements belonged to the neolithic period, has found those belonging to the paleolithic period in the same locality, and believes that the evidence of the archæology of the district shows, contrary to the opinion held in regard to Western Europe, that there was no such hiatus between the paleolithic and neolithic periods, and that the series of implements run from one period to the other, their difference being accounted for by the general progress from the lower to the higher civilization. To this period of transition, Mr. Carlyle has given the name of "mezolithic."

It is not easy to determine the purpose of these small implements, especially the crescent, trapezoid, and scalene triangular, which have neither known prototype nor antetype. Some of the triangular and long-pointed ones might have served as arrow-heads. If they had been found on the California coast, they would, without doubt, have been thus attributed; but they are entirely different from any recognized arrow-heads in the Western Hemisphere. It has been suggested that they, or some of their kindred, might have been used for tattooing, but there is nothing more to favor this than its possibility and our ignorance of their real purpose. Some of the smaller and straighter objects might have served as needles or perforators. A possible use akin to that of tattooing might have been that of the medicine man for bleeding or scarifying. One can scarcely understand any use possible which should have required the infinite number of these implements or confined them to the one general locality.

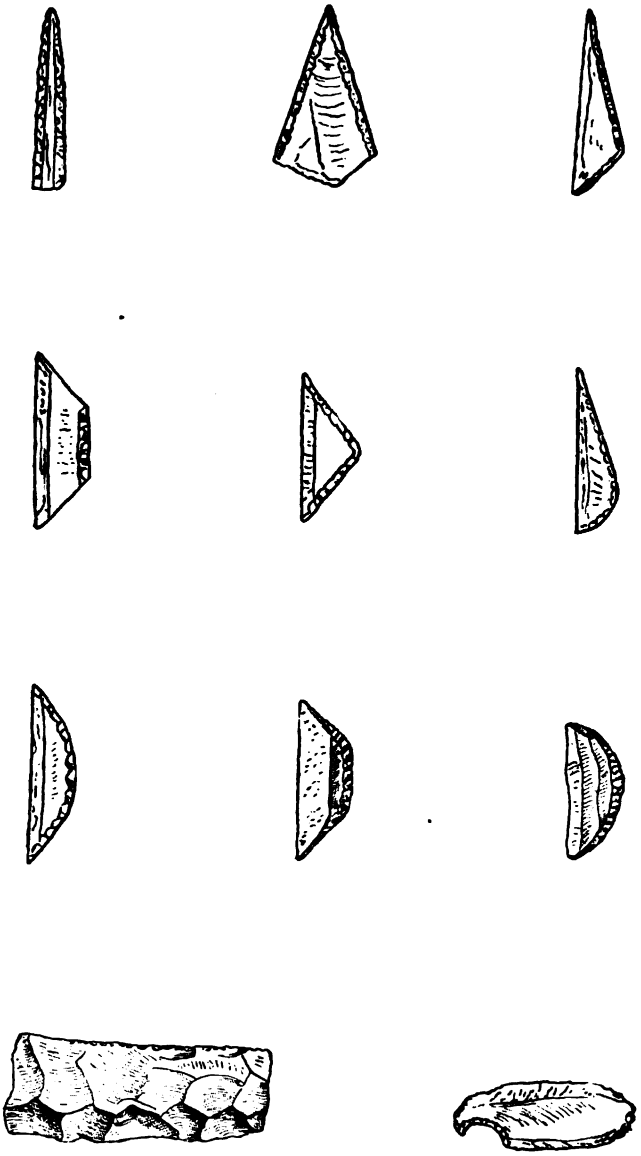
There surely is not enough distinctiveness in these implements to induce the belief that they form a racial distinction.

Mr. Carlyle reports that on the walls of some of the caves at Morahua Pahâr there were rude drawings of men and animals painted in red. They were of the usual character seen in pictographs of savage races, and the interest is increased by the fact that in these caves, and associated with these implements, rude pottery was found, roughly ornamented by incised marks which might have been made by some of these flakes. "These pieces of pottery," says Mr. Carlyle, "were rubbed



A Series of Minute Prehistoric Stone Implements from Caverns in the Vindya Hills, India.

Four-sevenths natural size.



MINUTE PREHISTORIC STONE IMPLEMENTS FROM CENTRAL AND SOUTHERN FRANCE.
Natural size.

down and smoothed by pieces of red hematite which had been brought from the laterite deposits." There were also grinding stones with which this hematite might have been ground into a paste, such as would serve to decorate the walls. These implements have been found by other travelers—other archæologists, one might say. Mr. Rivett Carnac has found them in the Panda district and described them in a paper entitled "Stone Implements from the Northwest Provinces of India," Calcutta, 1883. Sir John Evans has also described the discoveries of worked flints near Jubbalpur, in central India, in *Proceedings of the Society of Antiquaries*, second series, Vol. III. Prof. Haynes, of Boston, found some in Egypt; Bellucci found them in Tunis; the French army of occupation found them all along the northern coast. Adrian de Mortillet describes them in *L'Homme*, Vols. I and II, as from central and southern France. While those from France are similar to these now under discussion from India, yet it is to be suggested that they are not in sufficient number to be more than sporadic (Plate CIII). Mr. Merejkowski found some of these in the Crimea near Kizilkoda, and has described them in his *Premier recherche sur l'age de la pierre en Russie* (St. Petersbourg, 1880). Whether these are of types sufficiently pronounced and are found in sufficient numbers to have relation to the implements from India, I am unable to say.

CATALOGUE OF SMALL CHIPPED IMPLEMENTS FROM INDIA, SHOWING FORM, MATERIAL, AND LOCALITY.

Collected by Mr. A. C. CARLYLE.

CRESCENT-SHAPED IMPLEMENTS:	No.
Perfect: Morahua Pahâr: Agate, chalcedony, chert	26
Broken at both ends: Morahua Pahâr: Agate, chalcedony, jasper, chert	14
Some broken: Barkura, west of Morahua: Jasper, chert	13
Perfect: Partap Ganj: Agate	1
Perfect: Basâri, east of Maihiar: Agate and chert	2
Rude: Iathi, Riwa Territory: Carnelian, agate, chalcedony	5
Perfect: Barkura, west of Morahua Pahâr: Chalcedony	1
QUADRANGULAR:	
Barkura, west of Morahua Pahâr: Agate	1
Partap Ganj: Agate	1
TRIANGULAR:	
Barkura: Chalcedony	3
Morahua Pahâr: Agate, jasper	2
Likhneya Pahâr: Agate	1
Magardah Pahâr, Mirzapur district: Agate	5
Fields near Banda: Agate	1
Fields near Banda: Agate, chalcedony	3
LONG, NARROW-POINTED IMPLEMENTS WITH ROUNDED BUTT:	
Moretha Pahâr: Agate	1
Morahua Pahâr: Agate	1
Partap Ganj	1
IMPLEMENTS WITH SLOPING END:	
Barkura: Chalcedony	6
Moretha Pahâr: Chert	2

IMPLEMENTS WITH SLOPING END—Continued.	No.
Barkura: Chert	2
Chorwa Pahâr, Laoriya Dah	2
Partap Ganj	1
Iathi, Riwa Territory: Jasper	1
Fields near Banda: Chert	1
Misir Gaon, south of Naon: Jasper	2
Magardah, Mirzapur district: Agate	2
Morahua Pahâr: Agate, chalcedony, etc	13
DRILLS:	
Likhneya Pahâr: Agate	2
Baghe Khor, West Bhains-awar: Moss agate, chalcedony	4
Moretha Pahâr	2
Moretha Pahâr	1
Bhagatpura near Hanumana: Jasper	1
CRIMPED-BACK FLAKES:	
Morahua Pahâr: Agate, Jasper, etc	13
ROUND-ENDED IMPLEMENT:	
Morahua Pahâr: Agate	1
POINTED IMPLEMENTS:	
Likhneya Pahâr: Agate	5
ROUND-ENDED IMPLEMENTS:	
Donga Pahâr, east of Satua	4
Moretha Pahâr: Agate	1
Amila Nāla Bhains-awar: Agate	4
LONG POINTED IMPLEMENT:	
Morahua Pahâr	1
SMALL OVAL IMPLEMENTS:	
Fields near Banda: Agate, chert., etc	4
SMALL, NARROW IMPLEMENTS WITH FINELY WORKED POINTS:	
Morahua Pahâr: Agate, chalcedony, etc	22
LONG, NARROW CURVED IMPLEMENTS:	
Morahua Pahâr: Chalcedony, agate, etc	9
ROUNDED ENDS:	
Bhains-awar: Agate	2
LONG, NARROW IMPLEMENTS:	
Round ends: Morahua Pahâr: Agate	3
Two faceted with triangular section: Morahua Pahâr	2
SMALL IMPLEMENTS OF VARIOUS SHAPES:	
Morahua Pahâr: Agate, chalcedony	14
Fields near Banda	7
SMALL FLAKES WITH MINUTE SECONDARY CHIPPING:	
Barkura: Chalcedony	1
POINTED IMPLEMENTS WITH SQUARE BACK:	
Barkura: Chert	4
Naro	8
KNIFE-SHAPED IMPLEMENTS:	
Naro	3
LONG, NARROW IMPLEMENTS:	
Naro	6
KNIFE-SHAPED IMPLEMENTS:	
Moretha Pahâr: Jasper, etc	6
LONG, THICK, AND NARROW IMPLEMENTS:	
Naro	4
CORES:	
Naro	2

	No.
LONG, NARROW FLAKES:	
Much chipped from use: Morahua Pahâr: Agate, chalcedony, chert	56
A few chipped: Morahua Pahâr: Agate, chalcedony	12
A few chipped: Partap Ganj: Agate, chalcedony	21
A few chipped: Markura: Chalcedony, agate, etc	30
FLAKES AND CHIPS:	
Very small; Morahua Pahâr: Agate, chalcedony, jasper	35
Narrow; used as side scrapers: Iogian Dari: Agate, jasper	3
Narrow; Phases of usage: Iogian Dari: Agate, jasper, chalcedony	6
Long and narrow: Kachnar Ki Pahâr: Agate, chert, etc	63
FLAKES:	
Long and narrow, mostly used: Moretha Pahâr	129
Long and narrow, mostly used: Barkura: Chert, agate	12
Long and narrow: Suwara Khâte, west of Kâtia Ghat, Southern Mirzapur District: Chalcedony	7
Small: Morahua Pahâr: Chalcedony, agate, chert	191
Small: Magardah, Mirzapur District	9
Small: Fields near Banda: Agate	25
Small: Amila Nala, West Bhains-awar: Agate, etc	4
Used: Magardah, Mirzapur District	11
SCRAPERS:	
Okhara Pahâr; West Hanumana, north part of Riwa Territory	1
Balnathka Pahâr, Mirzapur District: Chalcedony	6
Likhneya Pahâr: Agate	1
Bhains-awar: Rock crystal	1
BOAT-SHAPED IMPLEMENTS:	
Bhage Khor, West Bhains-awar	2
Moretha Pahâr	1
SPOON-SHAPED IMPLEMENTS:	
Naro	6
SAWS (?):	
Naro	2
LONG, CUTTING IMPLEMENTS:	
Naro	4
Likhneya Pahâr	7
SCRAPER:	
Gusrû, south of Maihiyar	1
FLAKES USED AS KNIVES:	
Lakhahar Pahâr	3
Naro	10
Fields near Banda	10
LARGE CHIPPED IMPLEMENTS:	
Donga Pahâr, east of Satna	2
FLAKES POSSIBLY USED AS SCRAPERS:	
Iathi, Riwa Territory: Chalcedony, agate	19
Bhains-awar: Jasper	20
Misir, south of Naon: Jasper	9
Suwara Khate, South Mirzapur District: Quartz	6
Partap Ganj	7
SCRAPERS:	
Basari, west of Maihiyar	4
Chorwa Pahari, Laoriya Dah	2
Rajapour, Riwa Territory	6
Baghe Khor, near Bhains-awar: Jasper	3
Gadur Hata, West Naogaon Riwa	3

Scrapers—Continued.	No.
Nawa	1
Chilahwa Nala, Riwa Territory	2
Flakes:	
Primari chipping: Partap Ganj	10
Primari chipping: Naro	7
Secondary chipping: Hanumavi, Riwa Territory: Chalcedony	1
Secondary chipping: Dhir	5
Secondary chipping: Hills between Parari and Mahatain	4
Secondary chipping: Barkura	6
Secondary chipping: Barkura	15
Three or four faceted: Barkura	4
Some with secondary chipping: Barkura	14
Large and small: Babura, Mirzapur District	5
Large and small: Maro	14
Large and small: Chorwa Pahari, Laoriya Dah	5
Large and small: Singhpur Patar Kachar	10
Large and small: Naro	5
Long and narrow: Morahua Pahâr	9
Long and narrow: Naro: Agate	14
Some with secondary chipping: Kot Tirath, South Chilrakot: Agate	11
Some with secondary chipping: Moretha Pahâr	9
Some with secondary chipping: Rajapur: Agate, jasper	5
Some with secondary chipping: Naro	7
Long and narrow: Moranah Pahâr	13
Long and narrow: Amila Nāla, west Bhains-awar	6
Flakes and scrapers:	
Marpha	23
Moretha Pahâr	14
Partap Ganj	22
Chilahwa, Nāla, Riwa Territory	14
Kodaila Pahâr, west of Partap Ganj	15
Naonka Pahâr, north of Partap Ganj	8
Knife with square back:	
Naro	1
Pottery and bones:	
Baghe Khor, near Bhains-awar	6
Flakes with secondary chipping:	
Fields near Banda	9
South of Kalinjar: Agate, chert, etc	36
Cores:	
Various localities: Agate, chert, chalcedony	81

PALÆOLITHIC (?)

Scrapers; large, roughly chipped:	
River gravels of the Gawr Riwa: Jasper, chert, etc	24
River gravels of the Nabada Riwa: Jasper, chert, etc	9
Flakes and scrapers, large and roughly chipped:	
Marpha: Basalt	12
Various localities	51
Thick scrapers:	
Various localities: Chert, jasper, etc	111
Rude implements:	
Various localities: Chert, jasper, etc	10
Flakes:	
Various localities: Agate, etc	47

COMPARATIVE OÖLOGY OF NORTH AMERICAN BIRDS.

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The only object of this paper is to bring together what is already well known in regard to the oölogy of North American birds, placing it before the ornithologist in a more condensed form than it is usually given and in a comparative way. The question of the variation in the matter of form and coloration of the eggs of the birds of this and other countries has interested the writer for many years, and in the light of our present knowledge of the relations existing between birds and reptiles, both in this age and the past ages of the world, I have often wondered at what the causes were that eventually brought about the variation in color and form of which I have just spoken.

So far as the writer is concerned, he is not aware of the discovery of the eggs of any of the now extinct forms of reptiles, either fossil or subfossil, and it is beyond all probability that we will ever know what the eggs of *Archæopteryx*, or any of the toothed birds of the Kansas Cretaceous beds (*Hesperornis*, *Ichthyornis*, and others), or, indeed, any of the smaller extinct types of Aves, looked like. We have in our possession but very little upon this subject. Of the extinct *Dinornis* of New Zealand, and of the ponderous *Æpyornis* of Madagascar, also extinct, we have their eggs in a subfossil state, but except in the point of size they probably did not markedly depart from those of existing Ostrich types of birds (*Struthionidæ*) now living and most nearly related to them.

All of the eggs of the common African Ostrich (*Struthio camelus*) that I have examined have been of a more or less ellipsoidal form, unitinted, and with hard, flinty, and externally polished shells.* Their peculiar mode of incubation is well known and has been faithfully described by Lichenstein.† During the breeding season a cock Ostrich associates with four or five hens and the latter all lay their eggs in the same nest until some thirty are deposited. The male bird incubates during the night and the hens take turns during the day.

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*North African Ostriches, strange to say, differ remarkably from those of the Cape of Good Hope birds, in so far as the eggs of the former have a perfectly smooth, ivory-like surface, while those of the latter are rough-surfaced and dinted all over with minute punctures; yet no specific difference seems to obtain between the forms of the birds themselves from the two localities mentioned.

† Lichenstein, M. H. K.: Reise im südlichen Africa, II, pp. 42-45 (Berlin, 1812).

The main facts to bear in mind here are that the eggs average about 30 in number, are ellipsoidal in form, and are unspotted, being a yellowish-white in color, with a hard shell. The South American Ostriches (*Rhea*) essentially agree in these characters.* We meet with exceptions, however, among the *Ratitæ* in the Cassowaries and Emus. The mode of incubation here is much the same as in the Ostriches, but Cassowaries (*Casuaridæ*) lay dark-green and rough-shelled eggs, while the Emus (*Dromæidæ*) make a shallow nest in the ground, in which they lay from 9 to 13 eggs of a bluish-green to a dark bottle-green color; the period of incubation being eighty days, the cock bird performing the duty of hatching. *Apteryx* lays but a single egg two or three times a year. It is enormous for the size of the bird, and is deposited in a hole in the ground. Authors differ in their opinion as to the question of incubation. Some hold it is performed by both sexes, while others contend that it is performed only by the female. The Ratite birds are, structurally, the most reptilian forms of the class *Aves* we have in existence, yet were we to depend upon a study of their methods of incubation and their eggs it would be but an uncertain clew as to what we might be led to expect either in the higher groups of carinate birds, or in existing reptiles, or in extinct forms of either class, or finally, in lowly organized birds of other groups. We have the main facts, however, that in the *Ratitæ* the eggs may in number range from one to many; in color from yellowish-white to a green (never spotted or streaked, etc.); in form ellipsoidal (always?); and incubated by one or both of the sexes. Let us look at one or two other peculiar groups of birds and then pursue the subject in a different direction. In the case of the Penguins (*Impennes*), they lay two white or greenish-white eggs in a rude nest on the ground or in a burrow, while, on theother hand, the Tinamous (*Crypturi*) lay eggs which are "remarkable objects, curiously unlike those of other birds. Their shell looks as if it were of highly burnished metal or glazed porcelain, presenting also various colors, which seem to be constant in the particular species, from pale primrose to sage green or light indigo, or from chocolate brown to pinkish orange."†

Incubation is performed by the male,‡ a strong Ratite character; nest "a mere scrape, insufficiently lined with a few grass-leaves."§ Herr von Nathusius has further observed that the minute structure of the eggshell of a Tinamou "is quite different from that of the true Galli, and more resembles that of apteryx."* In form they are more or less globular and completely opaque. This last-named character in the eggs of birds is a very interesting one to the student. Prof. Newton, who has thrown so much light for us upon the subject of avian oölogy, remarks upon this point that "In form, eggs vary very much, and this is sometimes observable in examples not only of the same species but even from the same mother, yet a certain amount of resemblance is usually to be traced according to the natural group to which the parents belong. Those of the Owls (*Strigidæ* and of some of the *Picariæ*—especially those which lay the glossy eggs above spoken of—are often apparently spherical, though it is probable that if tested mathematically none would be found truly so; indeed it may be asserted that few eggs are strictly symmetrical, however nearly they may seem so, one side bulging out, though very slightly, more than the other. The really *oval* form with which we are most familiar needs no remark, but this is capable of infinite variety caused by the relative position and proportion of the major and minor axis. In nearly all the *Limicolæ* and some of the *Alcidæ* the egg attenuates very rapidly towards the smaller end, sometimes in a slightly convex curve, sometimes without perceptible curvature, and occasionally in a sensibly concave curve.

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* Newton, A.: Art. "Rhea," Encyclo. Brit., 9th ed., Vol. xx, p. 506.

† Newton, A.: Art. "Tinamou," Encycl. Brit., 9th ed., Vol. XXIII, p. 403.

‡ Bartlett, Mr.: P. Z. S., 1868, p. 115, Pl. XII.

§ Hudson, Mr.: In Argent. Orn. v. II, p. 210.

The eggs having this pyriform shape are mostly those of birds which invariably lay 4 in a nest, and therein they lie with their points almost meeting in the center and thus occupying as little space as possible and more easily covered by the brooding parent. Other eggs, as those of the Sand Grouse (*Pterocleidæ*), are elongated and almost cylindrical for a considerable part of their length, terminating at each end obtusely, while eggs of the Grebes (*Podicipedidæ*), which also have both ends nearly alike, but pointed, are so wide in the middle as to present a biconical appearance.†

The remarkable variation in both color and form of the eggs of many of our North American birds can nowhere be better studied and appreciated than is the splendid quarto (with its many beautifully colored plates), recently published by Capt. Bendire,‡ and in the treatises of corresponding magnitude of other authors, as those of Wolley, Thienemann, Hewitson, Brewer, of this country, Taczanowski, Lefèvre, Bädeker, and special memoirs in the publications of the learned societies.

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* Journ. für wissensch. Zoologie., 1871, pp. 330–355. Mr. Lucas, of the U. S. National Museum, tells me that the egg of Apteryx is white, and the shell like that of a hen's egg.

† Newton, A.: Art. "Birds" Encycl. Brit., ninth ed., vol. III, p. 775. See also in this connection the valuable contributions to the subject by des Murs, Triaté général d'Oologie ornithologique (8 vo. Paris: 1860).

‡ Bendire, Charles: Life Histories of North American Birds, with special reference to their breeding habits and eggs, 12 lith., plates Washington, 1892. (U. S. Nat. Mus.) Special Bull. No. 1. The author of this superb work promises to produce in the future similar volumes treating of other groups of our birds. Those dealt with in the present installment are the gallinaceous birds, the Pigeons, and Birds of Prey, in which latter group he includes the somewhat heterogeneous assemblage of the American Vultures, the *Falconidæ*, and the Owls.

With the information then upon the form of birds' eggs in general given as above by Newton, and the facts that birds so low in the scale of organization as the Ostriches, Emus, Cassowaries, Apteryx, Tinamous, and Penguins lay eggs varying all the way from 1 to 30, being either globular or ellipsoidal in form, white or unitinted in color, with highly polished shells or the reverse case, I turned to the oölogy of existing reptiles to ascertain if possible what its study would offer in contrast. With this in view I communicated with my friend Prof. Samuel Garman, of the Museum of Comparative Zoölogy of Harvard College, and in his reply the following facts were kindly placed at my disposal.* That distinguished herpetologist, observes: "All eggs of reptiles, so far as I know, are white. Those eggs with a limy covering are pure white; those leather-covered, without the lime, are sometimes dingy to yellowish, or flesh tinted. Marine tortoises lay spherical eggs. So, also, do various river tortoises, as *Podocnemys* of the Amazon. In species laying ellipsoidal eggs individuals sometimes vary to the spheroidal, in the snapping tortoise (*Chelydon*) for instance. Some of the land or box tortoises lay a very small number of eggs, possibly the smallest among the reptiles. The largest number is attained by sea tortoises, species of which are said to lay more than 200 in a season. The Crocodiloidea also lay large numbers. Some of the smaller lizards lay very few; the average will probably be smaller in lizards than in tortoises or snakes. The lizard's eggs with which I am acquainted are all ellipsoidal in shape. A near approach to the spheroid is made in some cases, as *Gonatodes*, a small Geckoid. The greatest departure from the spheroid is seen in some snakes, as for instance *Scatophis* or *Pityophis*. Of tortoises or lizards I know none that incubate, though some of the latter have acted as if keeping guard over the eggs until hatched. As you are aware various lizards and snakes hatch the eggs before extrusion, being ovoviviparous. The pythons coil around the eggs to hatch them. Both ends of the reptile egg are usually alike; neither is pointed as in a bird. The alligator, as you know, has a habit of nesting like that of the *Megapodes* of the birds."

It is as well to remark at this point that, according to Wallace,† the

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*Dr. Leonard Stejneger, curator of the department of reptiles, U. S. National Museum, also sent me a letter on the same subject, for which I desire to express my thanks. Such information as he was able to furnish me, however, is contained in Prof. Garman's letter, where the ground is more fully covered.

†Wallace, A. R., The Malay Archipelago, New York, 1869, p. 166. Upon pages 402 and 403 of this work the author also says of *M. wallacei* that it "comes down to the seabeach to deposit its eggs; but instead of making a mound or scratching a hole to receive them, it burrows into the sand to the depth of about 3 feet obliquely downward and deposits its eggs at the bottom. It then loosely covers up the mouth of the hole, and is said by the natives to obliterate and disguise its own footmarks

Megapodes lay *brick-red* eggs, and Sharpe tersely remarks in his Classification of Birds, "Nest *none*. Eggs deposited in a mound raised by many of the birds in concert. Young hatched without the intervention of the parent bird, and able to fly almost from birth" (p. 68). It would seem then that in the nesting habits of the *Megapodes*, we see not a little to remind us of the corresponding habits in some of the reptiles. According to Gibson crocodiles "are oviparous, depositing their eggs, from 20 to 60 in number and inclosed in a calcareous shell, in holes made in the sand or mud of the river side, where they are left to be hatched by the heat of the sun, or as in the case with certain American species, in hillocks formed by themselves which they hollow out and fill with leaves and other decaying vegetable matter, where the eggs are hatched by the heat generated in the decomposing mass."* The very distinguished herpetologist, Prof. E. D. Cope, also briefly writes me thus, his communication being dated Philadelphia, December 15, 1892: "As to reptile eggs I know of none excepting those of Crocodilia, which are not elliptic and white. Tortoises lay more eggs than either lizards or snakes, so far as known. No incubation among reptiles is known to me excepting in the cases of Pythonid snakes. I must add that a great deal remains to be known on the subject."

Among the CRACES the nest is placed in a tree, the eggs are *white* and two in number. (Sharpe, *loc. cit.*, p. 68.)

With the facts that I have enumerated in the foregoing paragraphs at our command, we can next pass to the consideration of the oölogy of the various groups of birds occurring in the avifauna of the United States, and here, relying as I do upon the published works of authors, who are widely recognized as authorities in such matters, I find the greatest amount of variance in the descriptions. These differences of opinion refer to the number of eggs laid by any particular species of bird, to the coloration of the eggs, and to the questions of nesting and incubation. In cases where, from the rarity of specimens, or where the eggs of certain species are known to vary even in the clutch laid by the same individual, and so on, there may be some excuse for this, but in cases where hundreds or even thousands of eggs of the same species have been examined by competent describers, it would seem that it is about time we had something like uniformity in description. This is only too frequently not the case, as the reader later on will soon discover.

Among our more lowly organized groups of birds stand the Divers (*Urinatoroidea*), and Grebes (*Podicipoidea*), related as they are to the

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leading to and from the hole by making many other tracks and scratches in the neighborhood. It lays eggs only at night. * * * All these birds seem to be semi-nocturnal. * * * The eggs are all of a rusty-red color, and very large for the size of the bird."

* Gibson, John, Art. "Crocodile," Encycl. Brit., 9th ed., vol. VI, p. 593.

extinct toothed-birds of the genus *Hesperornis*,[*] and yet their nidification is not as indicative of reptilian affinity as is that of some of the higher groups. Of course it is not at all likely that we shall ever know what the eggs of any of the toothed birds looked like, or much less what their breeding habits were, but it is fair to presume that it differed in important particulars from existing *Pygopodes*. I am of the opinion, however, that all the early reptiles and reptile-like birds laid *white* eggs, of either an ellipsoidal or of a spheroidal form, and they were not hatched by the parents. In number they may have been few or many.

Authors appear to be agreed that with respect to the Grebes they build a nest of rushes and sedges, etc., which to a greater or less extent floats upon the surface of the water in ponds and marshes among the reedy growths there occurring. They differ, however, in their descriptions of the eggs. Newton says their eggs have "a chalky white shell almost equally pointed at each end;"[†] Ridgway states "eggs 2 to 5, dull white, bluish-white, or very pale bluish-green," while Coues observes that "the eggs are more numerous than in other pygopodous birds, frequently numbering 6 to 8; elliptical, of a pale or whitish color, unvariegated; commonly covered with chalky substance.[‡] Dr. Sharpe, in his Classification of Birds, says the eggs are white,[§] but does not mention the number laid by members of this group. Both in form and color, then, Grebes' eggs remind us of reptiles', which is not the case in either particular with the Divers. Here we find according to Coues that the *Colymbidæ* "lay two or three dark-colored spotted eggs in a rude nest of rushes by the water's edge" (*loc. cit.*, p. 789), while Ridgway declares the eggs to be but two, "elongate-ovate, deep brown or olive, latter sparsely speckled or spotted with dark brown and blackish" (*loc. cit.*, p. 7). Sharpe says nothing about their being spotted, but that they are two in number and of a "dark olive-brown" (*loc. cit.*, p. 7). The eggs of these birds are probably spotted and the fact is an important one, as it is not only a point of difference between their eggs and those of the Grebes, but in that particular they differ from the eggs of any known reptile. They are the first eggs that have markings on them that we meet with among the lower groups of our birds. The difference in form is equally important, as it is likewise the first departure from the reptilian ellipsoidal or spheroidal form of egg, it being in the Divers larger at one end than it is at the other.

The **TUBINARES** is another group wherein we find the birds laying, as a rule, an ovate or subovate egg that may be spotted or pure white.

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[*] Shufeldt, R. W., Concerning the taxonomy of the North American Pygopodes, based upon their osteology. Jour. of Anat. and Phys., vol. XXVI, Lond., 1892, p. 199.

[†] Art. "Grebe," Encycl. Brit., 9th ed., Vol. XI, p. 80.

[‡] Ridgway, Robert: A Manual of North American Birds, 1887, p. 4. For the American Eared Grebe this author gives "eggs four to eight" (p. 6).

Coues, E. Key to North American Birds, 1884, rev. ed., p. 793.

[§] *Loc. cit.*, p. 71.

The following table compiled from Coues's Key (rev. ed.) and Ridgway's Manual will fairly present the oölogical characters of this group.

Oölogy of North American Tubinares.

Species, etc.	Coues.	Ridgway.
General characters, the Albatrosses.		Egg single, ovate or elliptical ovate, white, sometimes speckled or sprinkled on large end with reddish brown (p. 50).
D. albatrus	Single egg, on the ground. nearly equal ended; white; both sexes incubate.	
Phæbetria fuliginosa		Egg white, minutely sprinkled with brown on larger end (p. 53).
PROCELLARIIDÆ		Egg single, white (unless adventitiously stained) (p. 53).
Fulmarus glacialis	Egg single, white, with rough brittle shell, resembling a hen's egg in size and shape (p. 778).	
Puffinus puffinus. (Manx Shearwater.)	Egg single, dead white, smooth, 2.35 × 1.60 (p. 786).	
Oceanodroma leucorhoa, Leach's Petrel.	Egg single, white; nest in burrows in the ground (p. 781).	

Passing next to the Auks (ALCÆ) we find Dr. Sharpe briefly referring to them as follows: "Egg single, white when in a burrow, otherwise of varied and beautiful color and markings when laid on a rock" (*loc. cit.*, p. 71), and Coues states it differently, inasmuch as he says "eggs few or single, plain or variegated" (Key, p. 797.) Ridgway agrees with Sharpe, declaring the "egg single," though "variable as to form and color" (Manual, p. 8). Coues, in describing the egg of *Alle*, again finds an exception to Sharpe's diagnosis, for he says the "single egg" laid by that bird is pale greenish-blue (Key, p. 811), but confirms his statement given above that Auks lay more than a single egg, in his description of *Uria grylle*, and he remarks of that species, the Common Black Guillemot, that the "eggs, 2 to 3, sea-green, greenish-white or white, spotted and blotched most irregularly with blackish-brown, and with purplish shell markings" (Key, p. 815). According to this authority then an Auk may lay as many as 3 eggs, and another species may lay a blue unmarked egg. The Great Auk, probably now extinct, and one of the most ancient types of the suborder ALCÆ, laid, as we know, a single egg, which was a milk white, spotted and blotched with dark brown. In form the eggs of Auks assume some modification of the *ovate*, but are never ellipsoidal or spheroidal. We take it then, judging from such premises, that these birds stand much higher above the reptiles than do any of the Ostrich types. It would seem that this subject will bear its share of thorough revision, for as I write these lines I ascertain through the kindness of Capt. Bendire, who has kindly given me access to the superb collection of birds' eggs of the U. S. National Musem, that *Alle alle* normally lays 2 eggs, and that they are of a very pale greenish-blue, almost white. They are very uniform, both in form and color, and the collection contains eight or ten sets of them. This does not fully agree with either the statements of Coues or Ridgway; and we find similar discrepancies in the next suborder or the LONGIPENNES, as the subjoined table clearly shows.

Oölogy of Longipennes.

Species, etc.	Coues.	Ridgway.
General description	Eggs, generally 3, light-colored, with numerous heavy dark blotches. Nidification normally terrestrial. (Key, pp. 733, 774.)	None given. (Manual, p. 20.)
Xema sabinii	Eggs 3, * * * brownish-olive, sparsely splashed with brown. 1.75 × 1.25. (Key, p. 753.)	Eggs 2–5, * * * deep olive (varying in intensity, however), rather indistinctly spotted or blotched with brown. 1.78×1.26. (Manual, p. 38.)
Sterna antillarum. (Least Tern.)	Eggs, 1, 2, or 3 in number; ground color, varying from pale clear greenish to dull pale drab, speckled all over with small splashes, etc. 1.20 to 1.30 × 0.99. (Key, p. 767.)	Eggs 2–4, white, buffy white, or buff, spotted with brown or purplish gray. 1.28 × 0.91. (Manual, p. 46.)
Rhynchops nigra	Eggs 3 in number, pure white, spotted and splashed with dark browns and blackish, and pale neutral tint. (Key, p. 773.)	Eggs 2–5, white, buffy white, or pale buff, marked with large bold spots of rich dark or deep brown, and smaller, fainter spots of purplish gray. (Manual, p. 49.)

Gulls, Jaegers, Terns, and Skimmers (*Rhynchops*) all lay eggs of some form of the ovate or "short" ovate. *Chionis minor*, it may be interesting to know in this connection, "lays 2 or 3 eggs,"[*] which according to Dr. Kidder differ much in color, the general tint, however being a *café au lait*, irregularly blotched with several shades of dark sepia-brown, chiefly near the larger end; but according to Dr. Sharpe the blotches are of a "purple" color (*loc. cit.*, p. 72).

As we know, among the *Limicolæ*, the eggs are generally four in number, with a ground color of some shade of buff or olive, more or less spotted and blotched, and of a pyriform shape. The markings are commonly of some shade of brown, almost black in some instances, or purplish. Coues, in his "Key," ignores the eggs of a great many of the limicoline birds, including such interesting forms as the Woodcock, Oyster Catchers, and Turnstones. The study of the oölogy of this group is important, for "Perhaps the greatest scientific triumph of oölogists lies in their having fully appreciated the intimate alliance of the *Limicolæ* (the great group of Snipes and Plovers), with the *Gariæ* (the Gulls, Terns, and other birds more distantly connected with them), before it was recognized by any professed taxonomist, L'Herminier, whose researches have been much overlooked, excepted; though to such an one was given the privilege of placing that affinity beyond cavil" (Huxley, Proc. Zoöl. Soc., 1867, pp. 426, 456–458; *cf. Ibis*, 1868, p. 92).[†]

If for our present purposes we include in a suborder (HERODIONES) the Ibises, the Storks, the Herons, Egrets, Bitterns, and their natural allies, we have an interesting group, presenting a number of peculiarities in their oölogy. Dr. Sharpe says of the Ibises ("*Plataleæ*") that in *Platalea* the eggs are "greenish-white" with spots, while in *Ibis* they are "green" (*l. c.*, p. 75). Now, Coues makes the statement that the eggs of our American Spoonbill (*Ajaja*) are usually 3 in number, "nearly elliptical and white" (*Key*, p. 652), while Mr. Ridgway gives an entirely different description of them when he says that they are "ovate, white, or buffy white, blotched, spotted, and strained with various shades of brown" (Man., p. 123).

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[*] Kidder, J. H: Bull. U. S. Nat. Mus. No. 3, 1876, p. 7

[†] Newton A., Art. "Birds," Encyl. Brit., p. 773.

A similar confusion of description is extended to the eggs of Ibises. Coues says the eggs of the Glossy Ibis (*P. falcinellus*) are ovoidal in shape and "greenish-blue" in color (Key, p. 649), while Ridgway remarks that both Glossy Ibis and White-faced Glossy Ibis lay eggs of a "plain greenish verditer blue" color (Manual, p. 114); and Coues says the last-named species lays green eggs, 3 or 4, rarely 5 in number (Key, p. 651). Ridgway states that both the White Ibis and the Scarlet Ibis (*G. alba* and *rubra*) lay eggs that are "greenish-white, buffy, or pale brownish, stained, blotched, and spotted with brown" (Manual, p. 123). Coues describes the eggs (3 in number) of *G. alba* as being of a "dull, chalky white, blotched, and spotted with pale yellowish and dark reddish-brown" (Key, p. 651). When Dr. Sharpe in his description said the eggs of the *Ibis* were "green," as cited above, he must have referred to the Glossy Ibis, and *not* the Sacred Ibis (*Plegadis falcinellus* and *not Ibis æthiopica*), though he says "*Ibis*." Newton observes that the eggs of the Sacred Ibis "are of a dingy white, splashed, spotted, and speckled with reddish-brown;" and further remarks of the Glossy Ibis (*P. falcinellus*) that "one of the most remarkable things about this species is that it lays eggs of a deep sea-green color, having wholly the character of heron's eggs, and it is noticed that it often breeds in company with herons, while the eggs of all other Ibises, whose eggs are known, resemble those of the Sacred Ibis." (Art. "Ibis," Encyl. Brit., v. XII, p. 607.)

Tantalus loculator, according to Coues, lays "eggs 2 to 3, elliptical in contour, shell rough, with flaky substance; color white (Key, p. 653), while Ridgway contends that the eggs of this bird are "usually more or less stained, in streaks, with pale brownish." (Manual, p. 125.)

Mr. Ridgway says that all our North American Herons (*Ardea*, *Nycticorax*) lay "plain, bluish-green eggs, varying in depth of color" (*l. c.*, p. 128); Sharpe remarks that the eggs of the *Ardeæ* are "generally blue" (*l. c.*, p. 75); while Dr. Coues pretty thoroughly covers the ground for the Herons when he observes that they "are altricial, and generally nest in trees or bushes (where their insessorial feet enable them to perch with ease), in swampy or other places near the water, often in large communities, building a large, flat, rude structure of sticks. The eggs vary in number, coincidently, to some extent, with the size of the species; the larger Herons generally lay 2 or 3, the smaller kinds 5 or 6; the eggs are somewhat elliptical in shape and usually of an unvariegated bluish or greenish shade." (Key, p. 656.) When we come to the Bitterns, however, a peculiar difference is to be noted, and the description of their oölogical characters are set forth in the subjoined table:

Eggs of American bitterns.

Species.	Coues.	Ridgway.
Botaurus lentiginosus	Nests on the ground; eggs, 3–5; brownish-drab, with a gray (*not* green) shade. 1.90 to 2.00 × 1.50. Key, p. 664.)	Eggs pale olive-drab, orp ale isabella color. 1.88 × 1.43. (Manual, p. 126.)
B. exilis	Eggs, 3–5, elliptical, white, with faintest tinge of bluish 1.92 × 1.22 (*l. c.*, p. 665).	Eggs white, or greenish-white. 1.20 × 0.93. (*l. c.*, p. 127).

If the Bitterns are to be considered as a subfamily of the *Ardeidæ* (*Ardeæ* Sharpe), it can not be truly said that all the representatives of such a group lay *blue* eggs.

More uniformity seems to exist among authors in their descriptions of the eggs of the Cranes, Rails, and their allies (suborder PALUDICOLÆ). Selecting the works I have thus far consulted, we find the following characters variously given:

Oölogy of the Paludicolæ.

Species, etc.	Coues.	Ridgway.
Cranes (*Grus*)	Nest on the ground; eggs few (p. 666).	Eggs pale olive or olive buffy, spotted with brown, reddish-brown, and purplish-gray.
Grus americana	Eggs 2 (or 3?) 3.75 × 2.65 light brownish-drab, rather sparsely marked, except at great end, with large irregular spots of dull chocolate brown, with paler obscure shell-markings; shell rough, with numerous warty elevations and punctulate (p. 667).	Size 4.04 × 2.50.
Aramus		Eggs 4–7 (sometimes as many as 15? (2.32 × 1.70, pale dull buff, spotted, daubed, and stained with brown and purplish-gray (p. 136).
A. giganteus		
Rallas	The eggs are numerous, generally variegated in color (p. 670).	Eggs 6–15, white, buffy white, dull buff, or pale brownish-buff, rather sparingly spotted and speckled with rusty brown and purplish-gray (p. 137).
Porzana noveboracensis	Eggs about 6, rich, warm buffy-brown, marked at the great end with a cluster of reddish-chocolate dots and spots (p. 674).	Eggs 6 or more, creamy-buff densely sprinkled and speckled on larger end with rusty brown (p. 140).
Crex crex		Eggs about 11, light-buff or pale olive buff, spotted longitudinally with cinnamon brown or rusty and purplish gray (p. 140).
Ionornis martinica	Not recorded (p. 676)	Eggs 6–10, pale cream color or creamy white, speckled (sometimes, also, sparingly spotted), chiefly around larger end with brown and purplish gray (p. 141).
Gallinula galeata	Nidification exactly that of the coot (p. 675).	Eggs 8–13; buff, pale buff, brownish-buff, or buffy brown, sparsely spotted with dark brown (p. 141).
Falica americana	Eggs about a dozen, broad, shaped like an average hen's egg, clear clay color, uniformly and minutely dotted with dark brown, the spots usually mere pin-heads, sometimes large blotches. 1.75 to 2.00 long by 1.20 to 1.35 broad (pp. 676, 677).	Eggs 6–12, pale dull buff, finely dotted or sprinkled with brownish-black and purplish-gray. 1.91 × 1.32 (pp. 141, 142).

From what this table shows it would appear that in so far as their oölogy seems to indicate, the Cranes and Rails are not very intimately related and I find Dr. Sharpe, in his Classification of Birds, placing them widely asunder, though he retains the "*Arami*" with his GRUIFORMES (order XIX), and the "*Podicæ*" with the RALLIFORMES (Order X). Dr. Gadow retains them both in GRUIFORMES. (P. Z. S. 1892, pp. 244, 245).

Our next group is the STEGANOPODES, and I find considerable difference of opinion exists not only as to the number of eggs normally laid by steganopodous birds, but as to the general character of those eggs. Coues, in presenting the oölogy of the group, says: "The eggs are very few, frequently only one, usually if not always plain-colored, and incrusted with a peculiar white chalky substance" (p. 719).

THE SULIDÆ.

Dr. Sharpe	Egg, 1 only, white, with a chalky texture (p. 77).
Dr. Coues	Egg, generally single, is plain in color, and incrusted with a calcareous matter (p. 720).
(*Sula bassana*)	Egg, single, pale, greenish-blue, flaked over with white chalky substance (p. 720).
Mr. Ridgway (*Sulidæ*)	Eggs 1–2, elliptical or elongate-ovate, chalk-white superficially, but beneath the calcareous crust pale greenish-blue (p. 75).

THE PHALACROCORACIDÆ.

Dr. Sharpe (in the Anhingidæ)	Eggs four, white or light-blue, with a chalky texture (p. 77).
Dr. Coues (not including the *Plotidæ*)	Eggs are commonly two or three, of elliptical form, and pale greenish color, overlaid with a white chalky substance (p 726).
Mr. Ridgway (not including the *Anhingidæ*)	Eggs 2–5, elongate-ovate, pale bluish green, with a more or less continuous white chalky crust (p. 77).
Dr. Coues (*Plotus anhinga*)	Eggs 3–4, like cormorant eggs in color and texture, but narrow and elongate (p. 730).

THE PELECANIDÆ.

Dr. Sharpe	Egg, one only, white with a chalky texture (p. 77).
Dr. Coues (*P. fuscus*)	Eggs 2–3, white, chalky, elliptical (p. 723).
Mr. Ridgway (*Pelecanus*)	Eggs 1–4, oval, ovate, or elongo-ovate, with rough chalky shell, pure white, but usually much blood stained (p. 81).

THE FREGATIDÆ (Frigate birds).

Dr. Sharpe	Egg only one, white, much smoother than those of *Sula* (p. 77).
Dr. Coues (*Tachypetes aquilus*)	Eggs 2–3 in number, are greenish-white, with a thick smooth shell. 2.90 × 2.00. (P. 731.)
Mr. Ridgway (*Fregata aquila*)	Eggs (usually only 1), pure white, oval, ovate, or elongo-ovate. 2.70 × 1.83. (P. 83.)

Dr. Coues makes no record of the characters of the egg of *Phaëthon* in his "Key" (pp. 731, 732), but Ridgway describes the egg of the genus (common char.) as "egg ovate, dilute claret-brown or whitish, speckled, sprinkled, spotted or blotched with deep claret-brown" (p. 74). Dr. Sharpe says of his *Phaethontes*, "Egg, one only ; mottled reddish-brown" (p. 76). This is a curious departure from the steganopodous birds generally, and so far as it goes, reminds us of the *Longipennes* in color, that is being spotted, but *Steganopodes*, in being but one of them laid.

Prof. Newton says *Sula bassana* lays only a "single egg" with "a white shell of the same chalky character as a Comorant" (A. N., Art. "Gannet," Encyl. Brit., vol. x, p. 71), but that *Pelecanus*, or the Pelicans, lay "2 eggs commonly" (Art. "Pelican," *loc. cit.*, vol. XVIII, p. 475). Here certainly authors do differ most widely. Dr. Sharpe declaring that Pelicans lay but "one egg only." Prof. Newton says two, and Ridgway says they lay as many as *four*.

A similar diversity of opinion appears to be extended to the oölogy of the representatives of the next group of birds, the ODONTOGLOSSÆ.

Prof. Sharpe says the Flamingoes lay a "*single* white egg" (*l. c.*, p. 76), while most other authorities claim the clutch consists of *two* for those birds. Ridgway says "eggs [not how many] are pure chalk-white and of an elongate ovate, or cylindrical ovate" form. (Manual p. 121.) Possibly he may mean *two* or *more*.

Dr. Coues is positive about it when he observes for *Phœnicopterus ruber*, "Eggs 2, 3.25×2.10, with thick shells, roughened with white flaky substance, bluish when this is scraped away" (p. 679). Flamingoes' eggs have been known for a long time, and Newton, quoting Dampier, observes* that these birds "never lay more than two eggs and seldom fewer."

Coming next to the Swans, Geese, Ducks, and their allies (ANSERES), the statements are more uniform in character, and the general one of Dr. Coues "the eggs are usually of some plain pale color, as greenish, drab, or creamy; the clutch varies in number, commonly ranging from half a dozen to a dozen and a half" (p. 681); or that of Dr. Sharpe, "eggs numerous, creamy buff, or greenish white, or pure white" (p. 76), will probably cover the ground. Our Swans lay from 2 to 5 eggs, rough-shelled, and of a dull white color (Coues), while among the Geese we find *Philacte canagica* lays 5 eggs, which are white, "with fine pale brown dotting, giving a general pale dirty brown color," and *Branta canadensis* lays as many as "5 to 9, ellipsoidal, smooth, pale dull greenish" (Coues, pp. 686–688). The number becomes still greater among the Ducks, and our American Wigeon (*M. americana*) often lays as many as 12 eggs of a "dull pale buff" color, and the little Buffle-head (*C. albeola*) as many as 14, they being of an ellipsoidal form and of a "buffy-drab tint (between greenish-olive and rich creamy-white"

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*Newton, A.: Art. "Flamingo," Encycl. Brit. vol. IX, p. 286, cites Dampier, New Voyage round the World, ed. 2, corrected, vol. I, p. 71, London, 1697.

(Coues, p. 706). Eider Ducks also lay from 8 to 10 drab-colored eggs, and the Mergansers lay about an equal number—they being white in the Hooded Mergansers (*L. cucullatus*) (Ridgway). Swans and Geese, then, as a rule, lay the fewest number of eggs, and certain varieties of the smaller species of Ducks the greatest number, and at least one anserine bird lays spotted eggs (*P. canagica*—the Emperor Goose).

When we come to examine the oölogy of the great Columbo-gallinaceous group, one well represented in the avifauna of the United States, it is possible to make the comparisons quite extensive, owing to Bendire's exhaustive labors, as seen in his fine quarto volume already spoken of at the beginning of this paper. This I shall endeavor to do in a table, incorporating also the observations of Dr. Coues and Mr. Ridgway, and giving the majority of the species of the two suborders (*Gallinæ* and *Columbæ*):

Oölogy of American Gallinæ.

[Pagination after Dr. Coues's name refers to his "Key" (rev. ed. 1884), after Ridgway's to his "Manual," and after Bendire's his "Life Histories of North American Birds." Nomenclature of A. O. U. "Checklist."]

Groups, species, etc.	Dr. Coues.	Ridgway.	Bendire.
Colinus	Eggs white, pyriform, numerous (*Ortyx*. p. 589).	Eggs numerous (12 to upward of 20), pyriform-ovate, white, usually more or less stained (adventitiously?) with light brown (p. 187).	Eggs varying from 12–18; in form from round ovate to subpyriform in shape; are dull white in color, slightly glossy, sometimes stained with grass or soil (pp. 4, 6). *C. virginianus*.
Oreortyx pictus	Eggs colored; a minature of the ruffled grouse's, only distinguished by smaller size (p. 591).	Eggs cream color or creamy buff, varying in depth of color (p. 190).	Same as Ridgway. Shape short ovate; resemble unmarked eggs of ruffed grouse (p. 14).
Callipepla squamata	Eggs 10–12–16, rather elliptical than conical, white, minutely freckled with buff (p. 594).	Eggs white, buffy white or pale buffy, usually more or less distinctly sprinkled or speckled with brown (p. 191).	Number ranges from 9–16. Lusterless; pale buff; markings sharp, small, brown to fawn, equally distributed (p. 21).
Cyrtonyx	Not given	Egg (identification very doubtful) plain white (p. 194).	Eggs 10; rather glossy, white; generally ovate in form (p. 40).
Dendragapus obscurus.	Eggs creamy-buff, finely freckled all over with chocolate-brown, seldom with any large spots (p. 579).	Eggs 8–15, buffy or pale brownish, sprinkled, speckled, or more rarely spotted with dark brown (p. 194).	Eggs average 8–12; ovate in shape; pale cream to cream buff; more or less spotted over entire surface with fine dots of chestnut-brown (p. 49).
Bonasa umbellus	Eggs very characteristic, from creamy white to creamy buff, usually immaculate, sometimes minutely dotted, etc.; pyriform (p. 585).	Eggs 6–10 or more, buffy, usually plain, sometimes speckled with brown (p. 197).	Eggs 8–14, average 11, ovate or short ovate, milky white to pinkish buff, occasionally finely speckled, etc. (p. 63).
Lagopus	Eggs very heavily colored, with bold confluent blotches of intense burnt-sienna color, upon a more or less reddish-tinted buff ground (p. 586).	Eggs about 10–16, more or less heavily spotted or marbled with dark brown or black on a buffy or light-rusty ground (p. 198).	Eggs average 11–16, ovate to elongo-ovate, cream color to reddish buff, some specimens heavily marked with confluent blotches and markings (p. 74).
Tympanuchus	Pale greenish-gray, with sometimes a glaucous bloom, usually unmarked, sometimes very minutely dotted with brown (p. 584).	Eggs 8–12, light drab, olive, or dull buffy, etc. (p. 202).	

Oölogy of American Gallinæ—Continued.

Groups, species, etc.	Dr. Coues.	Ridgway.	Bendire.
Centrocercus	Essentially agrees with Ridgway.	Eggs 6–15, varying from pale olive buff to light olive greenish, speckled, sprinkled, or spotted with deep brown (p. 205).	Essentially ditto.
Meleagris	Not given	Eggs 10–18 or more, light buffy, thickly (but sometimes indistinctly) speckled or sprinkled with brown (p. 206).	The ground color varies from pale creamy white to creamy buff (p. 116).
Ortalis vetula maccalli.	Eggs generally 3, with a thick, granular, and very hard shell, like a guinea fowl's, oblong, oval, buff-colored, or creamy white, large for the bird (p. 573).	do	Do.

COLUMBÆ.

Groups, species, etc.	Dr. Coues.	Ridgway.	Bendire.
Columba fasciata	Eggs 2, equal-ended, white, glistening (p. 565).	For the family *Columbidæ*. Eggs 2, plain white or buffy white (p. 210).	Large for size of bird: * * * pointed elliptical ovate, pure white, glossy (p. 127).
Ectopistes migratorius	Eggs 1 or 2, equal-ended (p. 566).		Eggs 1 or 2, elliptical oval, pure white, slightly glossy (p. 138).
Zenaidura	do		Eggs 1 or 2, pure white, oval or elliptical oval, or elliptical ovate (p. 142).
Zenaida	Not given		Eggs 2, pure white and oval, more rounded than pigeons usually are (p. 144).
Engyptila	Not given		Eggs 2, elliptical oval, cream buff, glossy (p. 145).
Melopelia	Eggs 2, white or creamy (p. 569).		Eggs 2, seldom 1; when fresh a rich creamy tint; as incubation advances fades to a dull dead white (p. 147).
Columbigallina, Scardafella.			Eggs 2, white.
Geotrygon martinica			Not known.
Starnœnas			Not positively known.

As will be seen from this table, and as has long been known, the eggs of the Fowl series differ very materially from those of the Columbine series of birds. In this connection I quote the following from Dr. Sharpe: "As far as their osteology goes the sand grouse are very columbine, and had they occurred in a fossil state only they would probably have been placed in the Columbæ. * * * Nest none. Eggs three, double-spotted, equally rounded at both ends. Nestling Galline. Young clothed with down like the young of a Partridge, but more variegated with white tufts." (Class of Birds, p. 69.)

Among the *Cathartidæ* and Raptorial birds (ACCIPITRES), exclusive of *Striges*, we find a great diversity of eggs, both in the matter of form and color. This seems to be especially true of the Hawks, Eagles, and their allies, where not only the same species may lay very different-appearing eggs, but in some cases the same individual may do likewise and variously tinted eggs be discovered in the same clutch. According to Bendire the California Vulture (*Pseudogryphus*) lays *two* elongate ovate, slightly glossy eggs of a uniform light grayish-green color and unspotted. They differ from the eggs of other Vultures in that they are "close grained and deeply pitted" (p. 161). Of the Turkey Vulture (*Cathartes aura*) he observes that "two eggs are usually laid, occasionally but one, and very rarely three. These are among the handsomest eggs of the *Raptores*. Their ground color is generally a light creamy tint, occasionally a dull, dead white, with a very faint trace of green in some few instances. They are blotched, smeared, and spotted with various shades of reddish-brown, chocolate, and lavender, the markings usually predominating about the larger end of the egg, and very irregular in outline. In eggs belonging to the same set the markings frequently differ greatly in size and intensity, one being heavily marked and the other but slightly. Occasionally an egg is found which is entirely unspotted. The eggs also vary greatly in shape; the majority are elongate ovate, a few are ovate, others elliptical ovate, and now and then one is perfectly cylindrical ovate" (p. 164). *Catharista atrata*, on the other hand, lays eggs which "are readily distinguished from those of the Turkey Vulture by their different ground color, somewhat larger size, and fewer markings as a rule. By far the greater number of eggs are elongate ovate, a few are short ovate, others elliptical ovate. Their ground color is a pale gray-green; in none of the specimens before me can it be called a creamy white; the tint is perceptibly different. In an occasional specimen it may be called pale bluish-white, like well-watered milk, but the first-mentioned color predominates. "The markings vary from chocolate to reddish-brown of different tints, and mixed among these, in about half of the specimens, are found shell markings of lilac and lavender; in an occasional specimen these predominate over the first-mentioned tints. In the series before me all the markings are rather irregular in shape and are clustered about the larger end of the egg. They are usually large and seldom confluent. A few eggs are but slightly marked, and the spots are small and fine, but none are entirely unspotted." (*Loc. cit.*, pp. 167, 168.)

We now come to the *Falconidæ*, a group of birds which are known, as a rule, to lay very beautiful eggs, and one has but to examine the richly colored and thoroughly accurate figures in Capt. Bendire's work to fully appreciate this fact.

Ridgway observes that *Elanus leucurus* lays from 2 to 3 eggs, but Bendire says they lay more than that commonly, and that the "set varies from 3 to 5, generally 4." They are of great beauty, the "ground color is creamy white, and they are heavily marked over their entire surface with irregular confluent blotches and smears of dark blood red and claret brown, of different degrees of intensity, the smaller end being often the more heavily colored. But little of the ground color is visible in the majority of the specimens. Some sets are much lighter than others, possibly a second laying. The eggs are usually oval in shape." (Bendire.) Coues contends that one of these Kites may lay as many as 6 eggs, and that in form they are "subspherical." (p. 525.)

The question of the difference in egg markings of birds of the same species, or even, as I have said, in the eggs of the same individual, is one of great interest. From all that has been gathered it would appear to largely depend upon the physical condition of the parent bird at the time of depositing the egg. Captivity and fright have also their influence, the secretions of the oviduct being often checked or even entirely arrested at such times. Age likewise has much to do with it, and the fact is now pretty well established that the older a bird is the more intensely will its eggs be colored, meaning, as I do, of course, those species which lay colored eggs, either tinted all over or with varied markings. Young birds of the first season lay lighter eggs in all respects, for example, than those individuals which have bred for many years.

Another American Kite, *Ictinia mississippiensis*, lays, according to Bendire, usually but *two* eggs, or at the most 3. "They are rounded, ovate in shape, pale bluish white in color, and unspotted, or, as the rarest exception, show 'a few minute deeper blue shell markings.' (P. 179.) The eggs of this species were unknown to Dr. Coues. They are frequently adventitiously stained. The Everglade Kite (*Rostrhamus sociabilis*) also lays 2 or 3 eggs which are 'blotched, marbled, and stained with various shades of brown on a paler (sometimes bluish white) ground color.'" (Ridgway, p. 226.) In the Marsh Hawk we find a greater number of eggs laid (*Circus hudsonius*), as many as 6 according to Bendire (p. 186), and 8 in Ridgway's account (p. 226). They are commonly plain, with a white or bluish white ground color, but may be blotched and spotted with light buff and brown markings. They assume some form of the ovate in contour, and are generally glossy-shelled and smooth.

Oölogy of the genus Accipiter.

Species.	Ridgway.	Bendire.
A. velox	Eggs 2-5, white, greenish white, or bluish white, usually very heavily blotched with brown. 1.47 × 1.16. (p. 227.)	Eggs 4-5 (7 in one case), oval or short ovate; pale bluish or greenish white, heavily blotched, spotted, and marbled with various shades of brown. Some specimens ground color, hidden by confluent markings of cinnamon rufous. The different patterns of marking are endless in variety (p. 191).
A. cooperi	Usully plain bluish white, rarely faintly spotted with pale brownish. 1.93 ×1.50. (pp. 227, 228.)	Eggs 2-6 (varying with locality), pale bluish or greenish white (fades out in time). Many (50 per cent) are variously spotted (p. 195).
A. atricapillus	Eggs 2-3; white or glaucous white, sometimes very faintly marked with pale brownish. 2.31 × 1.74. (p. 228.)	Eggs 2-5; pale bluish white in color and unspotted (p. 198).

From this it will be seen that the eggs of Hawks may vary greatly in the same genus, from an unspotted white egg (*A. atricapillus*) to a *greenish white* egg, heavily marked all over (*A. velox.*).

Harris's Hawk (*Parabuteo*) also lays three or four eggs, which are white or a buff white, and show more or fewer light brown markings. About half the eggs of this species also lack markings. The eggs of our common Red-tailed Hawk (*Buteo borealis*), which I have collected upon numerous occasions, vary wonderfully in point of size. There are generally *four* to the clutch, and have a ground color of bluish white. Some have spots, others are irregularly marked with various brownish tints, which markings are of the greatest variety, no two specimens being exactly alike in pattern with respect to size, color, intensity, or distribution. Unspotted eggs occur in the same set with spotted ones. Bendire says of the Zone-tailed Hawk (*Buteo abbreviatus*) that its "eggs vary from 1 to 3 in number, usually 2, and seem to be for the most part unspotted. They are oblong oval in shape, pale bluish white in color, and the shell is rather smooth and finely granulated." (p. 233.)

Hawks of the genus *Falco* as a rule lay dark-colored eggs, more or less covered all over with markings of various shades of brown. *Falco mexicanus*, however, lays from 2 to 5 creamy white eggs, more or less sprinkled over with madder-brown spots and markings. Other whitish-colored eggs of species of this genus may have the ground color almost entirely hidden or obscured by the markings being so numerous and close together. The egg of the Aplomado Falcon is an instance of this kind. Audubon's Caracara (*Polyborus cheriway*) also lays from 2 to 3 eggs, which, according to Bendire, are "oval in shape; the ground color, when visible, which is not often the case, is creamy white, and in the majority of specimens is entirely hidden, the egg appearing to be of a uniform rufous cinnamon of different shades, some of the darker approaching vinaceous rufous. This is again overlaid with irregular blotches and spots of dark chocolate, claret, brown, and burnt umber. Most of these eggs are heavily marked, a few, however, only slightly, and in these the markings are usually small and more regular in outline, a few are unspotted, and although the ground color is not visible it is entirely overlaid with an even-colored cinnamon tint." (pp. 317, 318.) It would be impossible here, without far exceeding the limits of space, to begin to describe the eggs of the Osprey (*Pandion*). They are all wonderfully handsome, but vary in size, form, ground colors, and markings to an endless degree. To view Capt. Bendire's beautifully-colored figures of them (Pl. XI) one can hardly believe that they were laid by the same species of bird. Still the eggs of *Polyborus* shown upon the same plate vary quite as much and in the same particulars, and even more so in the matter of size.

Eagles, as in the case of the Falcons and Hawks, lay but few eggs, rarely more than three, and they also range from a pure white egg (*Haliaëtus leucocephalus*) to one showing upon its surface speckles, spots, blotches, and a clouding with brown and gray (*Aquila*). Bendire remarks of the Harpy Eagle (*Thrasaëtus harpyia*) that "I have been unable to find a correct description of the egg of this species," and he supplies one from the specimens of that bird in the U. S. National Museum, and observes "the eggs are white, with yellowish-brown dots and washes, and about as long, though not quite as heavy, as a hen's egg. Of these eggs the Harpy lays 4 or 5, but never hatches more than 2, and, if the Indians can be believed, feeds the first two eaglets that make their appearance with the contents of the remaining eggs" (p. 271).

Coming next to the PSITTACI, I find that neither Coues nor Ridgway give in their works the number of eggs laid by our Carolina Paroquet (*Conurus carolinensis*); the former says "eggs whitish, 1.40 × 1.05, elliptical in shape, rough in texture" (p. 496), and the latter, "eggs 1.39 × 1.07, ovate, short ovate, or rounded ovate, pure white" (p. 270). Dr. Sharpe says simply "egg white" for his Order *Psittaciformes* (p. 83). I am of the opinion that the fact is not exactly known, and the truth of the matter is, we stand sadly in need of a knowledge of much in the biology of this entire and large group of most interesting birds.

COCCYGES: The parasitic habits of the European Cuckoo (*C. canorus*) are too well known to require comment here, and Coues observes that "the American Cuckoos have been declared free of suspicion of such domestic irregularities; but, though pretty well behaved, their record is not quite clean: they do sometimes slip into the wrong nest. The curious infelicity seems to be connected in some way with the inability of the female to complete her clutch of eggs with the rapidity and regularity usual among birds, and so incubate them in one batch. The nests of our species of *Coccygus* commonly contain young by the time the last egg of the lot is laid" (p. 471). Such habits, however, are departed from by the genus *Crotophaga*, birds which build a large nest for the use of a number of the species to lay in in common. In *Geococcyx* and *Coccygus*, species that lay numerous eggs at irregular intervals, we find often a fresh egg just laid and perhaps a nestling half as large as the parent bird, with an intermediate gradation of eggs in various stages of incubation and young grading up to the size of the one just mentioned.

Crotophaga ani may lay as many as 8 eggs, which according to Coues are "greenish" and to Ridgway a "dull glaucous-blue," but they are always more or less overlaid with a white substance chalky in nature, that in the recently laid egg easily washes off. Our Ground Cuckoo (*Geococcyx*) also lays white eggs or of a pale buff-white, and there may be as many as a dozen deposited before the bird completes her irregularly lain clutch. Opinions do not agree as to the number of eggs laid by our common Yellow-billed Cuckoo (*C. americanus*), Dr. Coues stating "eggs 4 to 8, pale greenish" (p. 476), and Ridgway, "eggs 2 to 4, dull pale glaucous-green or glaucous-white" (p. 273). And the latter au- ity says of the Black-billed Cuckoo (*C. erythrophthalmus* "eggs 2 to 4, deep glaucous-green or verditer-blue" (p. 274). The present writer discovered the nest of one of this latter species many years ago in New England, and it had *four* eggs in and *two* nestlings. It was a very slight affair for a nest, loosely put together with scanty material of twigs, etc., and placed upon the horizontal bough of a small apple tree.

I have never seen the eggs of any of the TROGONES, and personally know nothing of the nesting of our United States species *T. ambiguus.* Prof. Newton, however, remarks, "so far as has been observed, the nidification of these birds is in holes in trees, wherein are laid without any bedding 2 roundish eggs, generally white, but certainly in one species (Quezal) tinted with bluish-green" (Art. "Trogon," Encycl. Brit., vol. XXIII, p. 584). Doctor Sharpe makes a like statement, but no exceptions thereto. "Nest in hole of tree, eggs white" (Class. of Birds, p. 82).

We have two species of Kingfishers (ALCYONES) in our avifauna, *Ceryle alcyon* and *Ceryle cabanisi.* Either species usually lay *six* pure white eggs of an ovate or oval form. They are characterized by having smooth, glossy shells, which in the case of the last named species is very thin and brittle, having the appearance of being composed of porcelain. Such glossy and glassy, pure, white eggs are also laid by every species of our Woodpeckers (PICI), and those birds are very numerous in our avifauna—nearly forty of them. Ridgway in his "Manual" barely mentions the eggs of these birds, and Coues simply says that in form they are "rounded" (p. 479). Most all the species lay 6 to the clutch, but in *Dryobates villosus* and *Colaptes* 7 are sometimes taken. Probably in nearly all the species the eggs are more or less of an oval or ovate shape; all that I have ever collected I have found to be so.

In noticing the eggs of our Owls (STRIGES), I will rely almost entirely upon Bendire's work, so frequently quoted in this article.

Oölogy of Owls.

Asio wilsonianus	Eggs 3–6 (sometimes 7); pure white; oval; shell smooth, finely granulated and rather glossy.
Asio accipitrinus	Eggs 4–7 (rarely more); white; oval to elliptical ovate; sometimes nearly equally pointed at each end.
Syrnium nebulosum	Eggs 2–4 (4 are rare); pure white; not very glossy; oval or rounded oval.
Scotiaptex cinerea	Eggs 2–4; dull white; broad elliptical oval.
Nyctala t. richardsoni	Eggs 3–7; pure white; oval; almost lusterless.
Megascops asio	Eggs 4–5 (rarely 7 or more); pure white; oval or nearly globular; moderately glossy.
Megascops flammeolus	Eggs 3–4; white, with a faint creamy tint; oval; shell strong, finely granulated; slightly glossy.
Bubo virginianus	Eggs 2–3; white; little or no gloss; rounded oval; shell thick, coarsely granulated.
Nyctea nyctea	Eggs 3–10 (usually 5–7); white, creamy tint in some cases; oblong oval in shape; no luster; a few corrugated lines starting a trifle beyond the center of the egg and run to the longer axis in most specimens.

Oölogy of owls—Continued.

Surnia ulula	Eggs 5-8; white; smooth; glossy.
Surnia u. caparoch	Eggs 3-7; white; oval or oblong oval; somewhat glossy; smooth, fine grained.
Speotyto cunicularia hypogæa	Eggs 6-11; (not rare to find 11); pure white when washed; rounded ovate and very glossy; shell close-grained and rather smooth.
Glaucidium gnoma	Eggs 4?
G. g. californicum	Eggs 3-4; dull milky white, with a faint creamy tint; lusterless; peculiarly pitted with punctures; very thin shells, almost semitranslucent.
G. phalænoides	Eggs 4; oval; compared with the last species shells much thicker; coarsely granulated; no pittings or punctures, but on the contary show a few slight protuberances on their surfaces.
Micropallas whitneyi	Eggs 2-5; commonly 3; pure white; oval; finely granulated and rather glossy.

From this table it will be seen that our largest Owls lay both the least number (*Bubo*) as well as nearly the greatest number (*Nyctea*) of eggs, the greatest number, however, probably being laid by the Burrowing Owls (*Speotyto*). In other words, it may be tersely said that our *Striges* lay from two to a dozen white, oval eggs, varying somewhat with the species.

An equally useful table for the oölogy of our CAPRIMULGI can be compiled from Dr. Coues's "Key," and his descriptions of the eggs of those birds is quite full.

The following is what he records upon the subject:

Oölogy of N. American Caprimulgi.

Antrostomus carolinensis	Eggs 2; 1.45 × 1.05; heavily marked in intricate pattern with browns and neutral tints.
A. vociferus	Eggs 2; 1.25 × 0.90; creamy white; heavily marked with browns and neutral tints.
Phalæonoptilus nuttalli	Eggs 2; 1.05 × 0.80; elliptical; white.
Nyctidromus albicollis	Eggs 2; 1.25 × 0.92; creamy buff, spotted with pinkish brown and lilac.
Chordeiles virginianus	Eggs 2; elliptical; 1.52 × 0.87; finely variegated with stone-gray and other neutral tints, over which is scratched and pitted dark olive-gray; but the pattern and tints are very variable.
C. texensis	Eggs 2; heavily veined and marbled; 1.20 × 0.87.

The most remarkable exception, if it be true, among these birds, then, is the *elliptical white egg* of *Phalæonoptilus*. For the *Caprimulgi* as a group, Dr. Sharpe says: "Eggs white, with scroll-like markings and spots" (p. 18), and Ridgway, for the family *Caprimulgidæ*, "Eggs deposited on bare ground, dead leaves, gravel, or sand, 2 broadly elliptical—oval, plain or spotted" (Manual, p. 297), and of *Phalæonoptilus nuttalli*, "0.99 × 0.78, plain dead white, usually with a faint buffy or pinkish tinge" (p. 299). This latter author's descriptions of the eggs of our Goatsuckers differ quite materially from those of Dr. Coues, which is probably due to the fact that the eggs of the several species themselves differ to such a marked degree both in color, form, and markings.

According to Newton, "The Guacharo (*Steatornis*) is said to build a bowl-like nest of clay, in which it lays 2 to 4 white eggs, with a smooth but lusterless surface, resembling those of some Owls." (Art. "Guacharo," Encycl. Brit. 9th ed. Vol. XXI, p. 227.) And we may add, this is not the only character we know of that indicates caprimulgo-strigine affinity.

The Humming-birds need not detain us long; and it is very remarkable that for so large a group there is such complete uniformity, so far as we are at present aware, in their oölogy. Tersely it may be said that the TROCHILI all lay *two pure white* eggs, large for the bird in any species, and generally of an elliptical-oval, or elliptical-ovate form. These eggs remind me somewhat of the eggs of our smaller existing lizards.

In another suborder, the CYPSELI we are still ignorant of the character of the eggs of several of the species, but those of *Chætura pelagica* are well known. In that species from 4 to 5 are usually in a set. They are pure white, and narrowly elliptical in shape. The eggs of *Cypseloides niger* have as yet not been collected by any naturalist that I am aware. The eggs, too, of *Micropus melanoleucus* are unknown to me.

Lastly we come to that great host of birds included in the PASSERES, and here I propose to contrast the descriptions of Coues and Ridgway, confining myself principally to the various genera, occasionally only to the family where the eggs of the birds in the latter are very similar. Where birds of the same group differ to any marked degree such differences will be noted. Where the eggs of others are unknown the fact will also be shown; and I trust that such a table, condensed and compared, although it may add nothing that is new to the subject, will yet prove to be useful to the working oölogist.

Oölogy of North American Passeres.

Families, genera, etc.	Coues.	Ridgway.
1. TYRANNIDÆ.		
Milvulus forficatus	Eggs 4–5; white, boldly blotched with reddish on the surface, and lilac shell-spots.	Eggs 3–5; .88 × 66; pure white or creamy white, boldly but sparingly spotted with rich madder-brown and lilac-gray.
Tyrannus tyrannus	Eggs usually 4–6, white, rosy, or creamy, variously spotted or blotched in bold pattern with reddish and darker brown surface spots and lilac shell-markings.	Eggs 3–5; white, spotted with rich madder-brown or chestnut, and lilac-gray. [Eggs of this genus are particularly handsome objects.—R. W. S.]
Pitangus derbianus	Not given	Eggs 3–5, buffy white, speckled and spotted (the markings mostly longitudinal), chiefly on larger end, with madder-brown and purplish gray.

Oölogy of North American Passeres—Continued.

Families, genera, etc.	Coues.	Ridgway.
1. TYRANNIDÆ—continued.		
Myiozetetes texensis	Not given	Eggs unknown.
Myiodynastes luteiventris	Not given	Not given.
Myiarchus	Eggs scratched and snarled, but chiefly scrawled lengthwise with dark brown in close and intricate pattern.	Eggs 3-6, curiously marked with fine penlines and intricate pencilings of black and various shades of rich purplish-brown over a buffy or creamy brown.
Sayornis	Eggs, white (sparsely dotted; *S. fusca*).	Eggs 3-6, pure white, sometimes finely but sparsely speckled round larger end with dark brownish.
Contopus	Eggs spotted	Eggs 2-4, pale cream-color, handsomely wreathed round larger end with spots of rich brown and lilac-gray or lavender.
Empidonax	Eggs spotted (*E. flaviventris*) or white (*E. minimus*); also *E. obscurus*, where they are 3-4 and large.	Descriptions of eggs of the difficult genus practically agree with those given by Dr. Coues: *E. acadicus* eggs 2-4; creamy white, spotted chiefly on larger end.
Pyrocephalus r. mexicanus	Not given	Eggs 2-4, pale olive buff, or dull buffy (rarely nearly white), boldly and heavily spotted, chiefly in wreaths around larger end or near middle, with dark vandyke-brown or brownish-black and purplish-gray.
Ornithion imberbe	Nest and eggs unknown	Not given.
2. OSCINES.		
Laniidæ	Eggs 4-6; speckled	Eggs 4-7, dull whitish, spotted with light brown or olive.
Ampelidæ	Eggs spotted; (narrow and elongate; 3-6. *A. cedrorum*).	Eggs 3-5, pale dull bluish or pale purplish-gray, spotted and dotted with dark brown, black and purplish.
Hirundinidæ	Eggs pure white, unmarked: *Iridoprocne bicolor*, *Tachycineta thalassina*, *Cotile riparia*, *Stelgidopteryx serripennis*, *Progne subis*. Eggs thickly speckled; *Hirundo horreorum*, *Petrochelidon lunifrons*.	Agrees with Coues.
Alaudidæ—		
Otocoris	Eggs very variable in tone, but always profusely and heavily marked with brownish-gray, or dark stone-gray, upon a grayish or greenish white ground; in some cases the whole surface nearly uniform.	Eggs 3-5, pale olive, pale dull buffy, dull olive, whitish, etc., finely but usually densely speckled or sprinkled with olive-brown (rarely pale cinnamon-buff, speckled with cinnamon rusty).
Certhiidæ	Lay numerous white speckled eggs (p. 272).	Eggs 5-9, white or creamy white, speckled or spotted, chiefly on or round the larger end, with reddish-brown.
Vireonidæ	(*Vireo.*) Eggs white, spotted (p. 330).	Eggs white, usually more or less dotted, or sparsely speckled round larger end with brown or blackish.
Motacillidæ—		
Motacilla		Eggs 3-5, whitish, thickly speckled with brown.
Anthus	Eggs 4-6, very dark colored	Eggs with pale ground color, but the dense speckling of brown gives nearly a uniform brown to the whole shell.
Sylviidæ—		
Regulus	Eggs 6-10; fully speckled	Eggs 5-10, whitish or buffy, minutely freckled with brown (sometimes apparently immaculate).
Polioptila	Eggs 4-5; fully speckled	
Cœrebidæ	Not given	(*Certhiola.*) Eggs 2-4, white or buffy white, finely speckled or sprinkled chiefly on larger end with umber brown.

Oölogy of North American Passeres—Continued.

Families, genera, etc.	Coues.	Ridgway.
2. OSCINES—continued.		
Mniotiltidæ	The American warblers lay from 3–7 eggs, some 3–4, etc. As a rule, they are white, or creamy white, or pale greenish or bluish white, or grayish, or even pinkish. They are more or less spotted, etc., chiefly round the larger end, with various shades of brown or lilac, or roan black, less commonly speckled all over. Species very numerous, and the eggs varying for each species.	
Siurus		Eggs 3–6, pure white or creamy white, spotted with reddish-brown and lilac-gray.
Icteria	Egg 3–5, white and speckled with brown.	
Cinclidæ	Eggs, about 5, pure white	Eggs 3–5, plain pure white.
Troglodytidæ	Eggs of three patterns, (1) those densely spotted; (2) those sparsely spotted, and (3) those pure white. Generally numerous, some species laying as many as 10. I give a species of each from Coues, using the nomenclature of his "Key."	
(1) *Telmatodytes palustrus*	Eggs 6–10, very dark colored, being so thickly dotted with chocolate-brown as to appear almost uniformly of this color.	
(2) *Salpinctes obsoletus*	Eggs, 5–8; crystalline whiteness, sparsely sprinkled with reddish-brown dots.	(*Campylorhynchus.*) Eggs with the ground color whitish, creamy white, or salmon buff nearly masked by dense sprinkling of reddish-brown, general hue light brownish-pink.
(3) *Cistothorus stellaris*	Eggs white	
MIMINÆ.		
Oreoscoptes	Eggs 4, light greenish-blue, heavily marked with brown and neutral tint.	
Mimus	Eggs 4–6, bluish-green, heavily speckled and freckled with several brownish shades.	
Galeoscoptes	Eggs 4–6, deep greenish-blue, not spotted.	
Harporhynchus		Eggs very variable in coloration, but usually speckled.
H. rufus	Eggs 4–6, whitish or greenish, speckled with brown.	
H. crissalis	Eggs, usually 2, emerald green, unspotted. (The exception for the genus.)	Eggs plain pale greenish-blue.
Turdidæ:		
Myadestes	Eggs, 4; bluish-white, freckled with reddish-brown.	Eggs, 3–6; whitish, speckled with reddish-brown.
Turdus		
T. mustelinus	Like *Merula migratoria*	Eggs, 2–5; plain greenish-blue.
T. aliciæ		Eggs greenish-blue, spotted with rusty brown.
Merula		Eggs, 3–5; plain bluish (very rarely speckled with brown).
Cyanecula suecica		Eggs, 3–5; pale olive, olive-greenish or brownish, deeper on or around larger end (sometimes uniform).
Saxicola œnanthe	Eggs, 4–7; greenish-blue without spots.	Eggs 3–6 plain, pale greenish-blue.
Sialia		Eggs, 4–7; plain, pale greenish-blue (very rarely white).
Paridæ:		
Parus	Eggs, 6–8; white fully sprinkled with reddish-brown.	(White, usually speckled).
Psaltriparus	Eggs, 6–9; white, unmarked.	(Pure white).
Auriparus	Eggs, 4–6; pale bluish, speckled with brown.	(Chiefly around larger end).
Tanagridæ	Dull greenish-blue, fully spotted with brown and lilac.	(*Piranga*): 3–5, bluish or greenish, spotted with brown.
Euphonia		Eggs creamy-white, with a few scattered spots and blotches, principally at the larger end, of two shades of brown.

Oölogy of North American Passeres—Continued.

FRINGILLIDÆ.

NOTE.—There are upwards of 150 species of Finches, Sparrows, Grosbeaks, Cross-bills, etc., in the United States avifauna, and they lay a great variety of eggs, and it would be quite impracticable to describe or classify even a part of them here, so I resort to the plan of only presenting the characteristic types. Of these eggs many are spotted, with a ground color of white, various shades of pale green and blue, and the spotting near the larger end in a wreath. White eggs, sparsely spotted, are not common, and in my selections I have endeavored to show the differences that exist.

Families, genera, etc.	Coues.	Ridgway.
Pinicola enucleator	Eggs 4; greenish-blue, spotted and blotched with dark brown and lilac shell-spots.	
Leucosticte	Eggs 3–6; pure white	Eggs pure white.
Spinus tristis	Eggs 4–6; bluish-white, normally unmarked.	

NOTE.—In the numerous species of the genera *Poocætes*, *Ammodramus*, *Melospiza*, *Junco*, *Carpodacus*, *Spizella*, *Loxia*, *Zonotrichia*, *Chondestes* (4–7, white, with zigzag lines, as in some *Iteridæ*), *Passerella*, *Calcarius*, *Pipilo*, and others, the eggs, although showing almost an infinite variety of patterns, all have the common character of *markings* upon them of some kind or other. They constitute the great bulk of United States "fringilline" birds. Exceptions are seen in the other genera as given below.

Families, genera, etc.	Coues.	Ridgway.
Amphispiza bilineata	Eggs 4–5, whitish, unmarked	Eggs plain greenish or bluish white.
A. b. nevadensis	Eggs greenish, profusely spotted, etc.	Eggs speckled with brown.

NOTE.—The case of *Amphispiza* is one of a plain egg and a marked one in the same genus of birds.

Families, genera, etc.	Coues.	Ridgway.
Peucæa		Eggs 3–5, plain white or bluish-white.
Embernagra	Eggs pure white, unmarked	Eggs 2–4, plain pure white.
Calamospiza	Eggs 4–5, pale bluish-green, normally unmarked, occasionally speckled.	Nest and eggs not distinguishable with certainty from those of *Spiza americana*.

ICTERIDÆ.

NOTE.—The so-called "Grosbeaks" of the genera *Habia*, *Cardinalis*, *Pyrrhuloxia* all lay handsomely marked eggs, but in the genus *Guiraca* the eggs are a "pale greenish-blue or bluish-white," and not marked. In *Passerina* (some of the species (*P. amæna*) the eggs are also plain.

Families, genera, etc.	Coues.	Ridgway.
Dolichonyx	Eggs 4–6, stone-gray, dotted, mottled, and clouded with dark brown.	Eggs 2–5, dull white or brownish-white, heavily spotted or blotched with vandyke-brown usually with a few fine lines or irregular markings of blackish.
Molothrus (parasitic)	Eggs white, fully speckled, and dashed with browns and neutral tints.	Dull white, greenish-white or brownish-white, speckled or spotted more or less densely with brown
Agelæus	Eggs 4–6; pale blue, fantastically dotted, blotched, clouded, and scrawled over with dark or even blackish-brown and paler or plurplish shell marks.	Agrees with Coues.
Xanthocephalas	Eggs 3–6; gray-green spotted, as in *Scolecophagus*, with reddish-brown, not scrawled as in *Agelæus*.	(Occasionally pen-lined.)
Sturnella	Eggs 4–6; crystal white, speckled with reddish and purplish (very variable).	Eggs 3–6; white, speckled with reddish-brown, blackish-brown and lilac-gray.
Icterus—		
I. galbula	Eggs 4–6; shaded white, irregularly spotted, blotched, clouded, and especially scrawled with blackish-brown, etc., and shell markings.	Description practically agrees

Oölogy of North American Passeres—Continued.

CORVIDÆ.

NOTE.—In the genus *Quiscalus* the eggs are also peculiarly marked, as in the Orioles, but not so with *Scolecophagus*.

Families, genera, etc.	Coues.	Ridgway.
Pica	Eggs 6–9; pale drab, dotted, dashed, and blotched with purplish-brown.	Eggs 3–10; pale olive-buffy, dull white, or very pale greenish, variously marked with brown.
Cyanocitta— *C. cristata*	Eggs 5–6, broad, drab-colored, with brown spots.	Eggs (3–5?), pale olive, isabella-color, greenish or buffy, rather sparcely spotted or speckled with brown.
Aphelocoma— *A. woodhousei*	Not specifically given.	Eggs 3–6, pale green, rather sparcely marked with very distinct dots or small spots of deep madder-brown.
Xanthoura— *X. luxuosa*	Eggs 3–4, greenish-drab, marked as usual with browns.	Eggs 2–4, pale buff or pale grayish-buff, thickly speckled with umber-brown.
Perisoreus— *P. canadensis*	Eggs 3–4, yellowish-gray or pale green, finely dotted and blotched with brown and slate or lavender, especially about the larger end; others more uniformly and largely blotched; variation wide, as in other jays.	Eggs dull white, drab-white, or very pale grayish-buff, speckled with hair-brown or grayish-brown or lilac-gray.
Corvus (common char.)	(*C. corax.*) Eggs 4–8, oftener 4–5, greenish, dotted, blotched and clouded with neutral tints, purplish and blackish brown.	Eggs 2–7, bluish-green, pale olive or olive, spotted or dashed (or both) with olive-brown (sometimes nearly uniform olive from density of markings).
Picicorvus— *P. columbianus*	Eggs light grayish-green, speckled and blotched with grayish-brown and lilac, chiefly about the larger end.	Eggs dull white, sparingly speckled, chiefly on larger end with brown and purplish-gray.
Cyanocephalus— *C. cyanocephalus*	Eggs 3–4, greenish-white, profusely spotted with light brown and purplish.	Eggs 3–5, pale greenish-blue or greenish-white, thickly but finely speckled with olive-brown.

STURNIDÆ.

S. vulgaris	Not given.	Egg 4–7, plain pale greenish-blue or bluish-white.

This article would not be complete did I not add to it some of the excellent observations of Prof. Alfred Newton and others relative to the eggs of birds. After I have done this, I will draw up my "Concluding remarks." Newton briefly gives us some excellent observations upon the "forms of the markings" on birds' eggs, and these it is not difficult to see "have been deposited on the shell a short time before its exclusion, are primarily and normally circular, for hardly any egg that bears markings at all does not exhibit some spots of that form, but that in the progress of the eggs through that part of the oviduct in which the coloring matter is laid on many of them became smeared, blotched, or protracted in some particular direction. The circular spots thus betoken the deposition of the pigment while the egg is at rest, the blurred markings show its deposition while the egg is in motion, and this motion would seem often to be at once onward and rotatory, as indicated by the spiral markings not uncommonly observable in the eggs of some birds of prey and others—the larger end of the egg (when the ends differ in form) making way for the smaller."*

"At the same time the eggs of a great number of birds have, besides these last and superimposed markings, more deeply seated stains, generally of a paler and often of an altogether different hue, and these are evidently due to some earlier dyeing process. The peculiar tint of the ground color, though commonly superficial, if not actually congenital with the formation of the shell, would appear to be diffused soon after." (Art. "Birds," Encycl. Brit., 9th ed., Vol. III, p. 773.) This distinguished ornithologist also invites attention to the fact that "the size of eggs is generally but not at all constantly in proportion to that of the parent. The Guillemot (*Alca troile*) and the Raven (*Corvus corax*) are themselves of about equal size. Their eggs vary as ten to one." (*Loc. cit.*, p. 775.) Many other examples of this among our American avifauna will be recalled by the thoughtful oölogist. Reasons for these discrepancies are not far to seek, *i. e.*, nestling Ravens lay long in the nest after birth, whereas young Guillemots are larger and better developed at the time of hatching. Then the number of eggs laid by a Raven may be as many as 8 (see table), and, as we know, the Guillemot lays but one, giving either bird about the same egg surface to cover during incubation.

From my reading of avian oölogical works I find that certain explanations, or partial explanations have been put forth as the reasons for the variations in the colors of the shells of birds' eggs. I formulate these as follows:

BIOLOGICAL LAWS EXPLANATORY OF THE VARIATION IN COLOR OF THE SHELLS OF EGGS IN THE CLASS AVES.

1. In many instances the general color and markings are in conformity with the law of protective coloration.

2. Where both sexes are more or less brilliantly colored the eggs are generally laid where they are not exposed to view, and where the parent hatching them is also concealed to a greater or less extent. This is effected by either the form of nest constructed or by the eggs being laid in burrows or hollow trees. The eggs of such birds are, as a rule, not handsomely marked, or often only white. Otherwise in general, irrespective of plumage, birds that lay in such places as have just been mentioned usually lay white eggs.

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*That the larger end is protruded first was found on actual experiment by Mr. Bartlett, superintendent of the gardens of the Zoölogical Society, to be the case commonly, but as an accident the position may be sometimes reversed, and this will most likely account for the occasional deposition of markings on the smaller instead of the larger end, as not unfrequently shown in eggs of the Sparrow Hawk (*Accipiter nisus*). The head of the chick is always found at the larger end. [For a beautiful example of the heavy deposition of nearly all the color at the small end of the egg, see the one figured by Bendire of *Accipiter velox*, Pl. V, Fig. 17.—R. W. S.]

3. Where the general tone of the plumage of the incubating parent is in harmony with its environment, the eggs, as a rule, are laid in open nests or places where they are fully exposed to view. Such eggs are frequently very handsomely tinted and marked, or the reverse may be the case.

4. When the female alone incubates, and is of dull or somber plumage, the male bird brilliantly feathered, the third law, as a rule, is operative.

5. Frequently birds that lay eggs in open and exposed places, as directly on the ground, rock, or sand, without any apology for a nest, their eggs are either tinted, or colored and marked, or both, so as to be in harmony with their surroundings.

6. It is probable that the earliest forms of birds laid white, ellipsoidal eggs, varying in number to the clutch from one to many. Possibly in some of the lower types of existing birds such an ancestral trait has persisted.

7. In certain instances where birds lay exposed to view either white or light tinted eggs, or those not otherwise protectively colored, they have the habit of covering the clutch over with leaves, etc., when, for any purpose, the incubating parent temporarily quits the nest.

8. Birds, irrespective of the character of the coloration of their plumage, which habitually lay in inaccessible places, their eggs are often either white or light-tinted and exposed to view.

9. Both the age of the bird and the physical condition of its constitution at the time of laying an egg have their influence upon the coloration of its shell. Changes in the constitution may be due to external causes, as fright, etc., or to internal causes, as disease, etc. The richest colored eggs of any species (that lay other eggs than white ones) are laid by that species at its prime.

10. The positions of the egg as it passes down the oviduct, as well as its motions, effect the pattern of its markings.

CONCLUDING REMARKS.

In the light of what has been presented in this paper we can now briefly review some of the oölogical peculiarities of the birds of North America.

Many Grebes (*Podicipoidea*) have the habit of covering over their numerous white eggs with bits of vegetation when the parent temporarily quits the nest (seventh law), but whether the Loons (*Urinatoroidea*) ever resort to this means of protection I am not at present informed, though I am inclined to think they do not. The eggs of the latter, however, harmonize better with their surroundings (fifth law).

The American *Tubinares*, with but one or two exceptions, as far as known, lay white eggs, but they are protected, from the fact that they are laid either in inaccessible or little frequented places (eighth law). Birds rather low in the scale of organization, as the Short-tailed Albatross (*D. albatrus*), which lay a "nearly equal-ended white egg," and where for many ages there may have been no special reason for it to take on any other form or a pattern of varied coloration, possibly may have done so through a long line of avian ancestors (sixth law). Among the *Alcæ* I am not sure whether *Alle* lays its two unitinted eggs in a concealed nest or the reverse. Otherwise the coloration of the eggs of the birds of this group can all be explained under the second, third, and eighth laws as given above. I am inclined to think that the handsomely marked eggs laid by the *Longipennes* gain protection under the operation of the fifth law, and in many cases where I have collected the eggs of Gulls and Terns I have noticed that they often harmonize admirably with their surroundings. It is almost a universally conceded fact that this is distinctly so in the case of the *Limicolæ*, where it is sometimes most beautifully exemplified.

Bitterns among the *Herodiones* are striking examples where the species lay unitinted eggs, but the sitting bird has a plumage that is in complete harmony with the environment of the nest. Even the long pointed brown or dark-green feathers of the back and head simulate the thin lengthy sedge leaves when matted in mass on the ground. With Herons which build in trees such a protection is less evident. In the *Rallidæ* both the plumage of the bird and the coloration of the eggs themselves are protective. This is also the case with the *Gruidæ*, another family of the *Paludicolæ*.

Passing next to the *Steganopodes* we meet with another group of bird forms, morphologically more or less lowly organized, which for ages in the world's history have probably laid their eggs in the most inaccessible of places, and it is just possible that the eggs they now lay, sometimes single and sometimes few (Cormorants), may be more or less like those that were laid by their very early ancestors. The elliptical white eggs of the *Sulidæ*, covered with a calcareous crust, are very different affairs from the more ordinary appearing eggs of water birds higher in the scale of organized bird life. And, notwithstanding their evident anserine affinities this may also apply to the Flamingoes (*Odontoglossæ*).

Oölogists generally express the opinion that the pale unitinted eggs of the Anseres are protected against the pillaging of ordinary marauders, from the fact that nearly all birds of this group build their nests or lay their eggs in inaccessible localities (eighth law). It must be remembered, however, and it is a very interesting fact, that in the case of the Swans (*Cygninæ*) the dull white shells of their eggs are frequently adventitiously stained by the soil and especially by the wet and decaying vegetation composing the rude nest in which they are deposited. This often discolors them with a brownish, dirty shade, thus rendering them the more difficult to be seen upon casual observation. This applies likewise to the eggs of many Ducks (*Anatinæ*). But Ducks, too, often lay drab, greenish or buffy tinted eggs harmonizing with their surroundings, and such hues are also characteristic of the eggs of the arboreal building Ducks, such as *Aix*, for example, which lays drab-colored eggs, smooth and ellipsoidal in form. The still more typical tree-Ducks of the genus *Dendrocygna* may lay white eggs (*D. autumnalis*).

With our *Gallinæ*, birds which always build their simple nests upon the ground, we find their large clutches of eggs either *white*, or else more or less protectively marked, or finally made so by adventitious staining (*Colinus*). These birds, however, as a rule, wear a plumage that is preëminently in harmony with the nest surroundings, and additional protection is undoubtedly afforded from the fact that the incubating birds are all close sitters. There is an interesting exception in this suborder in the case of the Massena Partridge (*Cyrtonyx*). This curious bird, described by Vigors in 1830, remained comparatively unknown up to the year 1890, at which time not an egg of the species was in the possession of science, and even at this writing it is one of the United States game birds with which we are the least familiar as to its breeding or other habits. Strikingly showy in plumage it lays a glossy, white egg, but it resorts to breed to the mountainous ravines in the western part of country, and this fact, in so far as man is concerned, at least, is the reason its nest has been so rarely discovered (eighth law). Judging from its other habits it is probably, too, a very close sitter.

Pigeons (suborder *Columbæ*) lay, as a rule, white eggs, and both sexes incubate in some of the species. Many of them are somber in plumage, and make their nests upon the ground, or very near it. So far as known they lay but two eggs to the set, but many of them breed several times in the season. Those, like *Ectopistes*, which formerly resorted to the forests in numberless hosts for the purpose, have been largely exterminated through man's agency. It would seem that with such a species it mattered not what color their eggs may have assumed, it would have afforded no protection whatever against any class of despoilers. On the other hand, a little dove-like *Columbigallina* frequently saves its eggs by the habit it has of pitching suddenly off the nest and fluttering about on the ground as if wounded, and leading away the would-be robber of its treasures. Still, this bird, too, will build in the most exposed sites about the habitations of men, where their very gentleness and familiarity often protects them. If many should resort to this latter practice, and men rarely disturbed them when breeding, it would manifestly afford a double protection, for egg-eating mammals and birds, so common in the forests, would not likely be found in such localities, and thus their nests be exempt from plunder from such sources. Other birds, as many of the *Limicolæ*, have the trick of playing wounded when their eggs are endangered by man's approach; but it is a question in my mind whether, in many cases, it does not defeat its very object, inasmuch as it often inspires the intruder to search for the nest. I have never had the opportunity to observe how the subterfuge affects other animals below man.

The Accipitrine birds lay, as a rule, notoriously handsome eggs, but they are commonly protected in two ways: (1) By the inaccessible places where the species build their nests, as well as from the fact (2) that many of the larger raptorial birds are fully capable of defending them against robbery, often driving off man himself. Buzzards (*Cathardidæ*), I believe, never defend their eggs by direct attack, nor do I personally know of an instance where they vomit the contents of their stomachs over the intruder, as I have had some of the Herons serve me (*Ardea virescens*). It is a remarkable fact that the eggs of *Cathartes* and *Pseudogryphus* differ so in their characters, and we have at present no explanation to offer on the subject. It has its significance, however, and future researches may solve such problems. Audubon states that our Carolina Paroquet deposits its two eggs, which are light greenish-white, in the hollow of a tree, and that many females of the species lay them together at the bottom of the same cavity (*Conurus*: PSITTACI). They are examples of the second law given above, and this apparently applies with equal truth to the TROGONES.

Exactly why the COCCYGES should lay either white or unitinted eggs the present writer, at this time, does not pretend to know. They fall under the exceptions to the third law, or are examples of somber-plumaged birds that lay eggs like those to which reference has just been made, in open and exposed nests. Possibly in the future such circumstances as the facts that *C. americanus* lays "*glaucous-white*" eggs. *C. erythrophthalmus* "*verditer-blue*" ones, and *Geococcyx* "*white*" ones may aid, slender as such clues usually are, in unraveling the true affinities of this group, but our knowledge in such premises must then be far more extensive than it is now.

The oölogy of ALCYONES, PICI, and STRIGES, in each and every group, affords strong support to the truth of the second law and its general proposition, as does that of all our caprimulgine birds (CAPRIMULGI), save *Phalæonoptilus nuttalli*, support the truth of the fifth law. The writer will be obliged to have the opportunities to study the surroundings of the places of deposit of the eggs of a great many Common and Nuttall's Whip-poor-wills before expressing an opinion as to why the first should lay an egg with a creamy-white shell, heavily marked with browns and neutral tints, and the latter a white one. It is remarkable in another light, for *Steatornis* and the owls lay white eggs.

Every variety of the means of protection exemplified in the case of the eggs of birds is to be seen in the TROCHILI. In the first place, the eggs of Humming-birds are inconspicuous from the fact that they are so small and few in number. The nests, also small, are frequently so constructed as to perfectly harmonize with the surroundings. The nests are often built in very inaccessible places, and so, difficult to be seen or reached on that account. The nests are sometimes so constructed as to hide the eggs from view; in most instances the plumage of the back of the incubating bird is in complete harmony with the environment of the nest, and, finally, the eggs are too small to be of any value scarcely to any egg-eating animal.

The somber-plumaged Swifts (CYPSELI), so far as is known of our North American species, lay their four or five white eggs in some cavity where they are hidden from the general view (second law, last part), and in this agreeing with some of the Swallows among the *Passeres* that do likewise.

There are some curious and interesting examples and departures to be seen in our great and compact group of passerine birds (PASSERES). If we consider the *Corvidæ* to be the most highly organized family of the suborder, and *Corvus* the highest genus, then in it we find the species laying somewhat numerous, dark-colored and marked eggs (*C. corax*); but these characters rapidly change directly within the family, for *Cyanocephalus* lays only three or four eggs, which are white, tinged with greenish and profusely spotted, and such characters are continued into the next group, the *Sturnidæ*, where, however, they are more prolific layers (*S. vulgaris*), and the eggs, as a rule, are not marked. Then, passing by for the moment all the intermediate interrelated families, we find in the Clamatores, *Tyrannus*, which lays but four or five eggs, white, boldly and handsomely spotted with brilliant browns, and yet, too, in that very family (*Tyrannidæ*) we discover *Empidonax minimus* laying white eggs and unspotted. But just how a Raven comes to lay dark-colored, heavily marked eggs, and a small Flycatcher white ones I am inclined to believe we shall never exactly know. They both in this particular come under the third law, the Raven under the first part of it and the Flycatcher under the second.

The matter of coloration for protective purposes in this group would hardly seem to account for the characteristic colors of the eggs of the several families of passerine birds; nor, as I have heard it advanced, has the light anything to do with it, although my own observations lead me to think that crows are more frequently away from their nests during the period of incubation than are the smaller *Passeres*. They are not as close sitters. Such a theory, however, immediately becomes untenable when we take species like *Ampelis cedrorum* and *Petrochelidon lunifrons* into consideration. The first lays a dark-colored, heavily marked egg in an open nest, the parent being a close sitter, while the second, a Swallow, lays a white, thickly speckled egg in a covered nest, and is not especially a close sitter. Other Swallows, which lay pure white eggs in burrows (*C. riparia*) may fall under the operation of the last part of the second law (see above). Affinity of the birds again seems to have hardly anything to do with it in some cases, for even among species very closely related the eggs are very different.

Good examples of this are seen among our wrens (*Troglodytidæ*). These birds all lay in places where their eggs are not exposed to view, yet some of them lay pure white eggs, and others those which are very dark and densely spotted. It is seen again in *Harporhynchus*, where *H. rufus* lays whitish eggs speckled with brown, and its first cousin in the same genus, *H. crissalis*, two emerald-green and unspotted eggs. Such apparent anomalies would appear almost to defy a correct solution.

When we come to the *Fringillidæ* it is even still more difficult to account for the peculiarities of the colors assumed by the shells of their eggs. Here we find species of the same genus, habits alike, nesting alike, and the localities inhabited much alike, and yet laying very different appearing eggs. For example, the Black-faced sage Sparrow (*A. bilineata*), which lays whitish, unmarked eggs, and the California sage Sparrow (*A. belli*), which lays greenish-blue speckled eggs.

Another interesting case is one that I have alluded to in my table on the oölogy of the *Passeres* given above, and we find it among the "Grosbeaks." Those birds, so called, usually all lay handsomely marked eggs; but the Blue Grosbeak (*G. cærulea*) lays a plain egg quite like the one laid by the Indigo Bird of the genus *Passerina* (*P. cyanea*), only larger. Now, the Blue Grosbeak in plumage and other characters is strikingly like an Indigo Bird, and I believe that this is an instance pointing to the affinity of the two forms; indeed, I further believe that the Blue Grosbeak is more nearly related to our Indigo Bird than are some of the other species they have placed in the same genus with the latter, as, for instance, *Passerina ciris* and *Passerina versicolor*, birds that lay pearly-white eggs speckled with brown of two shades. When I say this I am also aware that the eggs of the Indigo are occasionally speckled. In the popular mind the name "Grosbeak" has given the impression that a number of birds in this country so designated are much of the "same kind of species," whereas in reality the affinity in several instances is not so close as is generally supposed. For example, *Guiraca* is structurally much more nearly related to *Passerina cyanea* than it is to *Habia*, and still nearer than it is to either *Cardinalis* or *Pyrrhuloxia*.

Finally, among our *Icteridæ* we find beautiful examples of that class of cases (fifth law) where the male bird is of very handsome plumage; the female (the incubator) more or less somber in that respect; and where the eggs, more or less exposed to view (oftener less or partially concealed), are very remarkably and exquisitely decorated.

My examinations and studies of the oölogy of North American birds have clearly shown me that we should strive more and more towards correct and exact observation in such matters. It is especially needed to have before the oölogist abundance of material, and they should seek to employ a common nomenclature in the description of colors, tints, hues, and shades. This is also applicable to the descriptions of forms and to the measurements of eggs. In regard to the last, or the measurements of eggs, it is a matter of the very highest importance to the avian oölogist. Throughout the present paper I have frequently, but not always, contrasted the measurements as given us by different authorities, and it will be seen that the variance in statements in this particular is often quite as great as are the descriptions of form and color. The fact is the eggs themselves of the same species vary greatly in size, and averages taken from large series constitutes the only kind of data that can be safely relied upon. Nests and their environments are deserving of the most painstaking studies and descriptions, and frequent comparisons should be made of the nests of birds of allied families and groups. The best oölogical works are those which are fully illustrated with the most correct colored figures of eggs. In many instances a full knowledge of the breeding habits, nesting, and oölogy of birds will be of powerful assistance in determining the affinities of avian types. From a scientific standpoint avian oölogy has accomplished much in the past and will undoubtedly do so in the future.

SECTION IV.

BIBLIOGRAPHY OF THE U. S. NATIONAL MUSEUM FOR THE FISCAL YEAR ENDING JUNE 30, 1892.

BIBLIOGRAPHY OF THE U. S. NATIONAL MUSEUM, 1892.

I.—PUBLICATIONS OF THE MUSEUM.

ANNUAL REPORTS.

Annual Report | of the | Board of Regents | of the | Smithsonian Institution, | showing | the Operations, Expenditures, and Condition | of the Institution | for the | year ending June 30, 1889. | — | Report [of the | National Museum. | — | Washington: | | Government Printing Office. | 1891.

8vo., pp. xvii+883+50. 107 plates, 137 text-figures, and 7 maps.

PROCEEDINGS.

Smithsonian Institution. | United States National Museum. | — | Proceedings | of the | United States National Museum. | — | Vol. XIII. | 1890. | — | Published under the direction of the Smithsonian Institution. | — | Washington: | Government Printing Office. | 1891.

8vo., pp. viii+665. Plates I-XXXVII, text-figures 1-11.

The papers in this volume comprise Nos. 790-841, all of which were published separately during the fiscal year ending June 30, 1891. The date of publication of each paper is given in the Report for 1891, on pages 739, 740.

BULLETIN.

No. 39 is composed of several pamphlets containing instructions to collectors. Parts A-E have been published during the year. These are:

A. Directions for collecting birds. By Robert Ridgway.

8vo., pp. [1]-[27]. Figs. 1-9.

B. Directions for collecting recent and fossil plants. By F. H. Knowlton.

8vo., pp. [1]-[46]. Figs. 1-10.

C. Notes on the preparation of rough skeletons. By Frederic A. Lucas.

8vo., pp. [1]-[11]. Figs. 1-12.

D. Directions for collecting, preparing, and preserving birds' eggs and nests. By Charles Bendire.

8vo., pp. [1]-[10]. Six figures.

E. Directions for collecting reptiles and batrachians. By Leonhard Stejneger.

8vo., pp. [1]-[13]. Figs. 1-5.

Smithsonian Institution, | United States National Museum. | — | Bulletin | of the | United States National Museum. | No. 41. | Bibliographies of American Naturalists: | V. The published writings of Dr. Charles Girard. | By | G. Brown Goode. | — | Washington: | Government Printing Office. | 1891.

8vo., pp. 1-141. Frontispiece.

Smithsonian Institution, | United States National Museum.— | Bulletin | of the | United States National Museum. | No. 42. | A preliminary descriptive catalogue of the systematic | collections in economic geology and metallurgy | in the U. S. National Museum. | By | Frederic P. Dewey. | — | Washington: | Government Printing Office. | 1891.

8vo., pp. 1-256. Pls. 34. Figs. 10.

II.—PAPERS BY OFFICERS OF THE NATIONAL MUSEUM AND OTHER INVESTIGATORS WHOSE WRITINGS ARE BASED DIRECTLY OR INDIRECTLY ON THE COLLECTIONS OF THE MUSEUM.

ALPHABETICAL LIST OF NAMES.

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Ward, Lester F., U. S. Geological Survey; Honorary Curator, Department of Fossil Plants, U. S. National Museum.

Watkins, J. Elfreth, Curator, Section of Steam Transportation and Engineering, U. S. National Museum.

Wilder, Harris H., Northampton, Mass.

Williams, George H., Johns Hopkins University, Baltimore, Md.

Wilson, Thomas, Curator, Department of Prehistoric Anthropology, U. S. National Museum.

Yeates, William S., Assistant Curator, Department of Minerals, U. S. National Museum.

LIST OF PAPERS.

A. C. ADAMS and W. C. KENDALL. Report upon an investigation of the fishing grounds off the west coast of Florida.

Bull. U. S. Fish Commission, Vol. IX, 1889, pp. 289-312, 1 text figure, pl. CXI, 1891.

List of the Brachyura collected by W. C. Kendall, pp. 303-306.

CYRUS ADLER. Report on the Section of Oriental Antiquities in the U. S. National Museum, 1889.

Report of the Smithsonian Institution (U. S. National Museum), 1889 (1891), pp. 289-292.

ALEXANDER AGASSIZ. Reports on the dredging operations off the west coast of Central America to the Galapagos, to the west coast of Mexico, and in the Gulf of California, in charge of Alexander Agassiz, carried on by the U. S. Fish Commission steamer *Albatross*, Lieut.-Commander Z. L. Tanner, U. S. Navy, commanding.

I. Calamocrinus Diomedæ, a new stalked crinoid.

Mem. Mus. Comp. Zoöl., Vol. XVII, No. 2, 1892, pages 96, plates 32.

II. General sketch of the expedition of the *Albatross*, from February to May, 1891.

Bull. Mus. Comp. Zoöl., Vol. XXIII, No. 1, February, 1892, pages 89, plates 22.

The specimens collected on this expedition are being worked up under the supervision of Mr. Agassiz, after which a set will be deposited in the National Museum.

J. A. ALLEN. Further notes on Maximilian types of South American birds.

Bull. Am. Mus. Nat. His., New York, III, No. 2, 1891, pp. 199-202.

The species treated critically are as follows: *Myiothera ardesiaca* Max., made the type of a new genus; *Rhopocichla* Allen; *Anthos poecilopterus* Max. (*Geobates poecilopterus*); *Cypselus acutus* Max., identified as *Chætura cinereiventris* Scl.

J. A. ALLEN. On a collection of birds from Chapada, Matto Grosso, Brazil, made up by Mr. Herbert H. Smith. Part I, Oscines.

Bull. Am. Mus. Nat. Hist. III, No. 2, September 29, 1891, pp. 337-380.

Eighty-seven species are mentioned, of which *Calliste margaritæ* Allen (No. 31) and *Brachytrichia capensis costaricensis* Allen (p. 375)—the latter from Central America, however—are described as new. The critical notes accompanying this paper are extensive and important, embracing as they do descriptions of plumages previously undescribed, explanation of variations emendations of synonyms, etc.

J. A. ALLEN. The North American species of the genus *Colaptes*, considered with special reference to the relationships of *C. auratus* and *C. caper*.

Bull. Am. Mus. Nat. Hist., IV. No. 1, March 8, 1892, pp. 21-44, pl. ii.

A very elaborate treatise on a subject of the highest importance in connection with the question of the origin of species. The conclusion reached is that the numerous specimens of intermediate character are actual hybrids, and not mere "intergrades," thus confirming the views of Prof. Baird, published in 1858.

E. A. ANDREWS. Report upon the *Annelida Polychæta* of Beaufort, N. C.

Proc. U. S. Nat. Mus., Vol. XIV, pp. 277-302, pls. XII-XVIII, 1891.

The new species described are as follows: *Harmothöe aculeata*, *Eunice ornata*, *Diopatra magna*, *Ophelina agilis*, *Polydora commensalis*, *Axiothea mucosa*, *Petaloproctus socialis*, *Ammochares ædificator*, *Loimia turgida*.

EDWARD F. AYRES, WILLIAM S. YEATES and. (See under WILLIAM S. YEATES.)

BARTON A. BEAN. Fishes collected by William P. Seal in Chesapeake Bay, at Cape Charles City, Va., September 16 to October 3, 1890.

Proc. U. S. Nat. Mus., XIV, pp. 83-94.

A list of sixty-four species with an account of their abundance, habits, and common names.

BARTON A. BEAN. The Migration of Eels.

Forest and Stream. March 3, 1892, p. 199.

Review of Mr. H. C. Field's account of the migration of eels in New Zealand.

BARTON A. BEAN. A Cat-Fish in Armor.

Forest and Stream, March 24, 1892, p. 277.

Popular account of the Cascadura (*Hoplosterum littorale*) of Trinidad.

BARTON A. BEAN. New Hampshire Fish Culture.

Forest and Stream, March 31, 1892, pp. 302, 303.

Review of the Report of the Fish and Game Commissioners of New Hampshire, for the year ending December 1, 1891.

BARTON A. BEAN. World's Fair Fishes.

Forest and Stream, April 28, 1892, p. 401.

Mention of the fishes to be exhibited at the World's Fair, in Chicago, by the U. S. Fish Commission.

BARTON A. BEAN. Pacific Salmon and Trout.

Forest and Stream, May 5, 1892, p. 422.

Review of Dr. D. S. Jordan's account of the West Coast Salmonidæ, published as Bulletin 4, by the Board of Fish Commissioners of California.

BARTON A. BEAN. Fisheries of the Pacific States.

Forest and Stream, May 26, 1892, p. 501.

Review of U. S. Census Bulletin No. 167; statistics of the West Coast fish and fisheries.

TARLETON H. BEAN. Kennerley's Salmon.

Forest and Stream, July 9, 1891, pp. 498, 499.

An account of the distribution, size, colors, and life history of the species is here given.

TARLETON H. BEAN. Illinois Fish Culture.

Forest and Stream, July 9, 1891, p. 515.

Review of the Annual Report of the Illinois Fish Commissioners.

TARLETON H. BEAN. Whale, Walrus, and Seal.

Forest and Stream, July 16, 1891, p. 515.

An account of the breeding habits, etc., of these animals.

TARLETON H. BEAN. Wisconsin Fish Culture.

Forest and Stream, July 23, 1891, p. 8.

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TARLETON H. BEAN. Land-locked Salmon in Bisby Lakes.

Forest and Stream, July 30, 1891, p. 21. (Editorial.)

TARLETON H. BEAN. The Bluefish.

Forest and Stream, September 10, 1891, p. 147.

An account of its size, distribution, and life history.

TARLETON H. BEAN. New York Fish Commission.

Forest and Stream, October 8, 1891, p. 234.

(Review of the 20th Annual Report, Fish Commissioners of New York.)

TARLETON H. BEAN. Carp in California.

Forest and Stream, November 5, 1891, p. 305.

Review of its introduction into California.

TARLETON H. BEAN. The U. S. Fish Commission Exhibit.

Forest and Stream, November 5, 1891, p. 312.

Notice of exhibit being prepared for exhibition at the World's Fair.

TARLETON H. BEAN. Trout and Salmon in Mexico.

Forest and Stream, November 19, 1891, p. 353.

Account of the introduction of these fishes into Mexican waters.

TARLETON H. BEAN. Tench for American Waters.

Forest and Stream, November 26, 1891, p. 374.

Introduction of Tench into America.

TARLETON H. BEAN. Yellowstone Park Fishes.

Forest and Stream, December 3, 1891, pp. 392-393.

Review of paper upon the fishes found in the waters of the National Park by D. S. Jordan.

TARLETON H. BEAN. World's Fair Fishes.

Forest and Stream, December 17, 1891.

TARLETON H. BEAN—Continued.

Notice of two interesting forms recently obtained in the North Atlantic, *Lampris* and *Ruvettus*.

TARLETON H. BEAN. Jurisdiction over the Lakes.

Forest and Stream, December 24, 1891, p. 445.

An opinion as to the Government's power in replenishing and protecting the fisheries of Lake Ontario.

TARLETON H. BEAN. Pennsylvania Fish Commission.

Forest and Stream, December 24, 1891, p. 425.

Account of the annual meeting of this Commission held in Washington, D. C., December 18, 1891.

TARLETON H. BEAN. Impassable Fishways.

Forest and Stream, December 31, 1891, p. 466.

An editorial notice of the different kinds of fishways.

TARLETON H. BEAN. Slaughter of Birds and Fishes.

Forest and Stream, February 4, 1892, p. 97.

Editorial comments on the destruction of birds and fishes in Florida.

TARLETON H. BEAN. Massachusetts Fisheries and Game.

Forest and Stream, March 3, 1892, p. 200.

Review of the 26th Annual Report, Commissioners of Fisheries for Massachusetts.

TARLETON H. BEAN. The Menhaden.

Forest and Stream, March 10, 1892, p. 221.

Editorial comments on the life history and uses of the menhaden.

TARLETON H. BEAN. Protect the Black Bass.

Forest and Stream, March 24, 1892, p. 269.

A plea for the better protection of the black bass in waters of the United States.

TARLETON H. BEAN. Salmon spawning without going to sea.

Forest and Stream, March 24, 1892, p. 270.

Accounts of Salmon reproducing their kind in fresh waters.

TARLETON H. BEAN. Piscatorial exhibition in London.

Forest and Stream, March 24, 1892, p. 270.

An account of the exhibition of anglers' trophies at the Royal Aquarium, Westminster, England, February 18 to March 5, 1892.

TARLETON H. BEAN. Pennsylvania Fish Protective Association.

Forest and Stream, April 7, 1892, p. 317.

Editorial mention of its meeting in Philadelphia, March 29, 1892.

TARLETON H. BEAN. Effects of garbage on fish.

Forest and Stream, May 19, 1892, p. 469.

Comments on polluting waters with garbage.

TARLETON H. BEAN. Fisheries at the World's Fair.

Forest and Stream, May 26, 1892, p. 493.

TARLETON H. BEAN. Food for Fishes.

Forest and Stream, June 2, 1892, p. 515.

Editorial notice of paper by A. N. Cheney on this subject.

TARLETON H. BEAN. American Fisheries Society.

Forest and Stream, June 2, 1892, p. 524.

Report of the twenty-first annual meeting of the American Fisheries Society, held in New York May 25 and 26, 1892.

TARLETON H. BEAN. Fisheries on the Great Lakes.

Forest and Stream, June 9, 1892, p. 537.

Editorial notice of Mr. Herschel Whitaker's paper giving a history of the Great Lakes fisheries.

TARLETON H. BEAN. Sale of Reared Trout in Close Time.

Forest and Stream, June 9, 1892, p. 537.

Editorial notice of Mr. W. L. Gilbert's paper on the sale of trout from private waters.

TARLETON H. BEAN. A National Salmon Park.

Forest and Stream, June 16, 1892, p. 559.

Editorial notice of a proposed salmon park in Alaska.

TARLETON H. BEAN. Rearing fish for distribution.

Forest and Stream, June 23, 1892, p. 585.

Editorial analysis of papers upon the subject by prominent fish culturists.

TARLETON H. BEAN. Description of a new species of star gazer (*Cathetostoma albigutta*) from the Gulf of Mexico.

TARLETON H. BEAN. Notes on fishes collected in Mexico by Prof. Duges, with descriptions of new species.

Proc. U. S. Nat. Mus., xv, pp. 283–287.

(*Fundulus robustus*, *Acara bartoni*, and *Algansea dugesi* are described for the first time.)

CHARLES E. BENDIRE. Does the Rattlesnake Spit?

Forest and Stream, xxxviii. June 2, 1892, p. 518.

Controverts Prof. Cope's account of the rattlesnake's action in attacking.

JAMES E. BENEDICT. Decapod crustacea of Kingston Harbor.

Johns Hopkins University Circular, Vol. xi, No. 97, p. 77, April, 1892.

A list of thirty-eight species of crustacea collected at Jamaica by Dr. T. H. Morgan, with descriptions of one new genus, *Areograpsus*, and three new species *Eucratoplax spinidentata*, *Areograpsus jamaicensis* and *Sesarma bidentata*.

JAMES E. BENEDICT. Preliminary descriptions of thirty-seven new species of hermit crabs of the genus *Eupagurus* in the U. S. National Museum.

Proc. U. S. Nat. Mus., Vol. xv, pp. 11–26, 1892.

The genus is divided, according to the character of the left hand, into four subgenera, *Eupagurus*, *Trigonochirus*, *Elassochirus* and *Labidochirus*. Of the thirty-seven new species, twenty-eight are from the west coast of North America, one from the Galapagos Islands, two from the east coast of South America, and the remainder from Florida and the Caribbean Sea.

JAMES E. BENEDICT and MARY J. RATHBUN. The genus *Panopeus*.

Proc. U. S. Nat. Mus., Vol. xiv, pp. 355–385, pls. xix–xxiv, 1891.

A monograph based on thirty-eight species, twenty-five of which are contained in the Museum. Six species are described as new: *Panopeus areolatus*, *dissimilis*, *ovatus*, *angustifrons*, *hemphillii*, *bermudensis*.

JOHN C. BRANNER and FREDERICK V. COVILLE. (See under FREDERICK V. COVILLE.)

C. S. BRIMLEY. Bachman's Warbler (*Helmenithophila bachmani*), at Raleigh, N. C.

The Auk, viii, No. 3, July, 1881, pp. 316–318. Specimens taken April 27 and May 22, 1891.

AMOS W. BUTLER. Notes on the Range and Habits of the Carolina Parrakeet.

The Auk, ix, No. 1, Jan., 1892, pp. 49–56. Refers chiefly to "its distribution in Indiana and neighboring States, together with some notes upon its habits."

FRANK M. CHAPMAN. On the color-pattern of the upper tail coverts in *Colaptes auratus*.

Bull. Am. Mus. Nat. Hist., iii, No. 2, August 27, 1891, pp. 311–314.

Shows a remarkable individual variation in respect to the markings in question, page 314 showing illustrations of single feathers from fifteen individual specimens, each differently marked.

FRANK M. CHAPMAN. On the birds observed near Corpus Christi, Tex., during parts of March and April, 1891.

Bull. Am. Mus. Nat. Hist., iii, No. 2, August 27, 1891, pp. 315–328.

A well annotated list of thirty-three species, of which *Cardinalis cardinalis carinuchu* Chapm. (p. 324) is described as new.

GEORGE K. CHERRIE. Description of new genera, species, and subspecies of birds from Costa Rica.

Proc. U. S. Nat. Mus., Vol. xiv, No. 855, September 5, 1891, pp. 337–346.

New genera: *Deconychura* (p. 338), type, *D. typica*, new species; *Premnoplex* (p. 339), type *Margarornis brunnescens* Tawr. New species and subspecies: *Lophotriccus squamicristatus minor* (p. 337), *Lophotriccus zeledoni* (p. 337), *Pachyrhamphus ornatus* (p. 338), *Deconychura typica* (p. 339), *Vireo superciliaris* (Ridgway, MS.) (p. 340), *Basileuterus salvini* (p. 342), *Grallaria lizanoi* (p. 342), *Pachyrhamphus similis* (p. 343), *Arremon aurantiirostris saturatus* (p. 345), *Myrmeciza intermedia* (p. 345).

GEORGE K. CHERRIE. Notes on Costa Rican Birds.

Proc. U. S. Nat. Mus., xiv, No. 879, November 18, 1891, pp. 517–537.

Species and subspecies noticed critically are, (1) *Catharus melpomene*, (2) *Catharus mexicanus*, (3) *Campylorhynchus capistratus*, (4) *Henicorhina prostheleuca* (5) *Henicorhina leucophrys*, (6) *Thryophilus costaricensis*, (8) *Thryophilus thoracicus*, (9) *Thryophilus zeledoni*, (11) *Thryophilus semibadius*, (12) *Thryothorus hyperthrus*, (13) *Thryothorus melanogaster*, (14) *Thryothorus fasciativentris*, (15) *Oreothlypis gutturalis*, (16) *Dendroica vieilloti*, (17) *Geothlypis caninucha icterotis*, (18) *Geothlypis bairdi*, (19) *Basileuterus delattrii*, (20) *Basileuterus melanogenys*, (21) *Setophaga aurantiaca*, (22) *Vireo pallens*, (23) *Hylophilus ochraceiceps*, (24) *Cyclorhis flavipectus subflavescens*, (25) *Vireolanius puchellus verticalis*, (26) *Diglossa plumbea*, (27) *Dacnis venusta*, (28) *Euphonia gracilis*, (29) *Euphonia minuta*, (30) *Ramphocelus costaricensis*, (31) *Chlorospingus pileatus*, (32) *Buarremon gutturalis*, (33) *Dendrornis nana costaricensis*, (34) *Myrmeciza stictoptera*, (35) *Picolaptes compressus*, (36) *Philydor virgatus*, (37) *Grallaria intermedia*, (38) *Grallaria dives*, (39) *Ornithion imberbe*, (40) *Tyranniscus parvius*, (41) *Empidonax albigularis*, GEORGE K. CHERRIE—Continued.

(42) *Contopus lugubris*, (43) *Platypsaris aglaiæ*, (44) *Pachyrhamphus versicolor*, (45) *Pipra velutina*, (46) *Pipra leucorrhoa*, (47) *Pipra leucocilla*, (48) *Pipra mentalis*, (49) *Trogon elegans*, (50) *Antrostomus vociferus*, (51) *Coccygus minor*, (52) *Chloronerpes simplex*, (53) *Melanerpes chrysauchen*, (54) *Accipiter tinus*.

F. W. CLARKE. The relations of abstract research to practical invention.

Pop. Sci. Monthly, August, 1891, p. 540.

F. W. CLARKE. Table of atomic masses.

A leaflet published by C. F. Chandler, October, 1891, for the use of students in Columbia College.

F. W. CLARKE. Administrative report as chief chemist.

Tenth Annual Report of the U. S. Geological Survey.

F. W. CLARKE. The practical analysis of silicates.

Journ. Amer. Chem. Soc., December, 1891, XIII, p. 277.

F. W. CLARKE. Tschermak's theory of the chlorite groups and its alternatives.

Amer. Journ. Sci., March, 1892, pp. 190–200.

F. W. CLARKE. Report of the Department of Minerals in the U. S. National Museum, 1889.

Report of the Smithsonian Institution (U. S. National Museum), 1889 (1891), p. 401.

F. W. CLARKE. Report on Prof. Morley's researches.

Report of the Smithsonian Institution, 1890 (1891), p. 83.

F. W. CLARKE and E. A. SCHNEIDER. On the condition of certain micas, vermiculites and chlorites.

Amer. Journ. Sci., September, 1891, pp. 242–251.

F. W. CLARKE and E. A. SCHNEIDER. Experiments upon the constitution of certain micas and chlorites.

Amer. Journ. Sci., May, 1892, pp. 378–386.

F. W. CLARKE and E. A. SCHNEIDER. Ueber die Einwirkung des Salmicks bei Dissociation temperatur auf Silicate.

Ber. d. Deutsch. Chem. Gesell, 25, 883.

F. W. CLARKE, chief chemist, and others. Bulletin 78 of the U. S. Geological Survey. Report of work done in the division of chemistry and physics, mainly during the fiscal year 1889–'90.

F. W. CLARKE. Abstracts of various papers on atomic weights published from time to time in the Journal of Analytical and Applied Chemistry.

E. D. COPE. A critical review of the characters and variations of the snakes of North America.

Proc. U. S. Nat. Mus., XIV, No. 882, pp. 589–694.

The attempt is made to define with precision the species of North American snakes, together with their variations.

E. D. COPE. Color-pattern in *Cnemidophorus*.

Amer. Natural., XXV, 1891, pp. 1135, 1136.

The longitudinally striped pattern shown to pass in a transversely banded form.

E. D. COPE. Parallel color-patterns in lizards.

Amer. Natural., XXVI, 1892, p. 522, pl. xviii.

Calls attention to the parallelism of pattern development in *Lacerta* and *Cnemidophorus*.

E. D. COPE. The osteology of the *Lacertitia*.

Proc. Am. Phil. Soc., XXX, 1892, pp. 185–221, pls. ii–vi.

Descriptions of skeletons of various North American generic types.

E. D. COPE. On the characters of some paleozoic fishes.

Proc. U. S. Nat. Mus., XIV, pp. 447–463.

CHARLES B. CORY. Descriptions of new birds from the Bahama Islands, with remarks on the species of *Speotyto* which occur in the West Indies.

The Auk, VIII, No. 4, October, 1891, pp. 348, 349.

New species are as follows: (1) *Spindolis zena stejneger;* Elenthera I. (p. 348); (2) *Dendroica pityophila bahamensis*, Abaco (p. 348); (3) *Speotyto cunicularia bahamensis* Inagua (p. 348).

JOHN M. COULTER. Manual of the phanerogams and pteridophytes of Western Texas.

Cont. Nat. Herb., II, June, 1892, pp. 153–345.

This is the second part of a Manual of Western Texas. This number treats of the *Gamopetalæ* only.

FREDERICK V. COVILLE and JOHN C. BRANNER. A list of the plants of Arkansas.

Report of Geological Survey of Ark., IV, 1888, pp. 155–252.

This is a catalogue of all the known plants of Arkansas.

FREDERICK V. COVILLE. Description of new plants from Southern California, Nevada, Utah, and Arizona.

Biol. Soc. of Washington, VIII, 1892, pp. 65–80.

WILLIAM HEALEY DALL. Contribution à la Faune malacolojique terrestres des Ilss Galapagos.

Journal de Conchyliologie, Paris, XXXI, No. 4, pp. 314-316, October, 1891.

This is a brief synopsis of the malacological results obtained by Dr. G. Baur during exploration of the Galapagos Islands.

WILLIAM HEALEY DALL. On a new subgenus of meretrix (*Entwela*), with descriptions of two new species from Brazil.

The Nautilus, Philadelphia, July, 1891, Vol. V, No. 3, pp. 28–29.

Entwela perplexa Stearns from the Rio La Plata and *Entwela Iheringi* Dall from Southeastern Brazil, are described and figured.

WILLIAM HEALEY DALL. On some marine mollusks from the southern coast of Brazil.

The Nautilus, August, 1891, pp. 42–44.

This paper comprises a list of species from the region specified, mostly collected by Dr. H. v. Ihering.

WILLIAM HEALEY DALL. On some types new to the fauna of the Galapagos Islands.

The Nautilus, January, 1892, pp. 97–99.

This describes *Helicina nesiotica*, *Leptinaria chathamensis*, and *Zonites Bauri*, all new species, and notes the occurrence of a new species of *Pupa* and *Bulimulus* (*Pleuropyrgus*) *Habeli* Stearns.

WILLIAM HEALEY DALL. On the species of donax of Eastern North America.

The Nautilus, March, 1892, pp. 125, 127.

This paper gives the diagnostic features of the different species in tabular form, and describes as new *D. Emmonsi* and *D. aequilibrata* Dall from the late *tertiarius* of the Carolinas.

WILLIAM HEALEY DALL. On an undescribed *Cytherea* from the Gulf of Mexico.

The Nautilus, April, 1892, pp. 134, 135.

In this paper *Cytherea texasiana* is described from the coast of Texas.

WILLIAM HEALEY DALL. Geographical explorations. Early expeditions to the region of Behring Sea and Strait. From the reports and Journals of Vitus Ivanovich Behring, translated by William Healey Dall. Washington, Government Printing Office, 1891.

From U. S. Coast and Geodetic Survey, T. C. Mendenhall, Superintendent, Annual Report for 1890. Appendix 19, pp. 759-774; 4° with two maps. March, 1891.

This paper, separately printed as above with title page and cover, appears in the annual volume with the following heading:

"Notes on an original manuscript chart of Behring's expedition of 1725–1730, and on an original manuscript chart of his second expedition; together with a summary of a journal of the first expedition kept by Peter Chaplin and now first rendered into English from Bergh's Russian version."

WILLIAM HEALEY DALL. Tertiary Mollusks of Florida, Part II, Introductory. On the marine Pliocene beds of the Carolinas.

Wagner Free Institute of Science, Philadelphia, Transactions, Vol. IV, pp. 201-217, January 20, 1892.

The above was separately printed in advance, and contains a demonstration of the existence of true Pliocene beds in the Carolinas. The general conclusions were reprinted in the *Nautilus*, March, 1892, pp. 128–132.

WILLIAM HEALEY DALL. Obituary Notices, Emil Bessels.

Bull. Phil. Soc. of Washington, II, pp. 465, 466. September, 1891.

WILLIAM HEALEY DALL. Apropos des Pleurotomaria des Musees Americaines.

Bulletin scientifique de la France et de Belgique, Paris, 1891, XXIII, part 2, pp. 488, 489.

This note explains the condition in which the animals referred to reached America, and vindicates the authorities of the Museum from the charge of indifference or carelessness in utilizing this material, which had been made.

WILLIAM HEALEY DALL. Scientific results of explorations by the U. S. Fish Commission Steamer *Albatross*. XX.—On some new or interesting West American

THEODOR HOLM. Review of V. B. Wittrock's paper: De *Linaria Reverchoni* n. sp. Observationes morphologicae et biologicae in Acta horti Bergiani, Vol. I.
Botanical Gazette, XVII, p. 64.

THEODOR HOLM. Burnt Spots on Leaves.
Review of B. Jönsson's paper: "Om brannflac kar paa växtblad" in Botaniska Notiser, 1891.
Botanical Gazette, XVII, pp. 89-91.

THEODOR HOLM. On the vitality of some annual plants.
Amer. Jour. Sci., XLII, pp. 304-307, pl. X.
Description of some North American plants, which, though considered as annual, sometimes occur as perennial or biennial.

THEODOR HOLM. Vitality of Ferns.
Review of V. B. Wittrock's paper "De filicibus observationes biologicae" in Acta horti Bergiani, Vol. I.
Botanical Gazette, XVII, pp. 55, 56.

THEODOR HOLM. Anatomy of *Carices*. Review of A. Mazel's paper: "Etudes d'anatomie comparée sur les organes de végétation dans le genre *Carex*." Genève. 1891.
Botanical Gazette, XVII, pp. 56-58.

THEODOR HOLM. Anatomy of the stolons of *Gramineæ*. Review of P. Hellstroem's paper: "Naagra iakttagelser angaaende anatomien hos graesens underjordiska utlöpare." Bihang K. Sv. Vet. Akad. Hdlgr., XVI, 1891.
Botanical Gazette, XVII, pp. 121, 122.

THEODOR HOLM. Studies upon germination. Review of F. Hildebrand's paper "Einige Beobachtungen an Keimlingen und Stecklingen." Bot. Zeitung, 1892.
Botanical Gazette, XVII, pp. 122, 123.

THEODOR HOLM. The Home of *Calypso*.
Botanical Gazette, XVII, p. 133.

THEODOR HOLM. Review of Alida Ober's paper upon the structure of the pericarp of *Labiatæ* in Bihang K. Sv. Vet. Akad. Hdlgr., XVI.
Botanical Gazette, XVII, p. 133.

THEODOR HOLM. Review of O. Nordstedt's paper "A Monograph of the Australian *Characeæ*."
Botanical Gazette, XVII, p. 134.

THEODOR HOLM. Review of F. Kjellman's paper "Undersökning of naagra til slägtet Adenocystis Hook-fil hänforda alger" in Bihang K. Sv. Vet. Akad. Hdlgr. Vol. XV.
Botanical Gazette, XVII, p. 135.

THEODOR HOLM. Review of G. Lagerheim's paper upon the occurrence of European *Uredineæ* near Quito, Ecuador. Botaniska Notiser, 1891.
Botanical Gazette, XVII, p. 135.

THEODOR HOLM. The vegetation of the paramos of Venezuela. Review of Gœbel's paper "Die Vegetation der venezolanischen Paramos." Pflanzenbiol Schilderungen, Pars 2, 1891.
Botanical Gazette, XVII, pp. 159, 160.

THEODOR HOLM. The psammophilous flora of Denmark. Review of Eugen Warming's paper, "De psammofile Formationeri Danmark." Videnskab. Mddd. fra Naturlist Forening Kjobenhavn, 1891.
Botanical Gazette, XVII, pp. 220-222.

THEODOR HOLM. Third list of additions to the flora of Washington, D. C.
Proc. Biol. Soc. Washington, VII, pp. 105-132.
Enumeration of eighty species, new to the flora, and some localities of the rarer species, so as to show their distribution in the District.

THEODOR HOLM. Notes on the flowers of *Anthoxanthum odoratum L.*
Proc. U. S. Nat. Mus., XV, pp. 399-403.
This paper gives an account of the structure of the flower of this plant, a subject that has been discussed by several botanists before, and which has given very different ideas as to the

THEODOR HOLM—Continued.

conception of the structure. It seems that the present paper, based upon abnormally developed specimens, throws some light upon this very combined structure.

WILLIAM H. HOLMES. Illustrated catalogue of collections.

Third Annual Report of the Bureau of Ethnology, pp. 427–510, 84 text figs.

WILLIAM H. HOLMES. Ancient pottery of the Mississippi Valley.

Fourth Annual Report of the Bureau of Ethnology, pp. 361–436; 103 text figs.

WILLIAM H. HOLMES. Spurious Mexican antiquities and their relation to ancient art.*

Report of the Smithsonian Institution, 1886 (1889), pp. 319–334.

WILLIAM H. HOLMES. Ancient Pueblo pottery.

Fourth Annual Report of the Bureau of Ethnology, pp. 257–360; 150 text figs.

WILLIAM H. HOLMES. Ancient pottery of Chinqui.

Sixth Annual Report of the Bureau of Ethnology, pp. 13–187; 285 text figs., 1 pl.

WILLIAM H. HOLMES. Studies in aboriginal decorative art. Stamped ornament of South American earthenware.

American Anthropologist, January, 1892, pp. 67–72.

WILLIAM H. HOLMES. The rocking-stamp or roulette in pottery decoration.

American Anthropologist, April, 1892, pp. 149–152; 2 pls.

JOHN M. HOLZINGER. The identity of *Asclepias stenophylla* and *Acerates auriculata.*

Botanical Gazette, XVII, 1892, April, p. 124; May, p. 160.

L. O. HOWARD. A Note on Parasites.

Insect Life, IV, double number 1 and 2, October, 1890, pp. 48, 49.

A number of instances are given of error in the determination of the relations between host insect and parasite, and the frequent causes of error are pointed out and the necessity for great care insisted upon.

L. O. HOWARD. The Larger Corn-Stalk Borer.

Insect Life, IV, double number 3 and 4, November, 1890, pp. 90–103.

Historical account and life history of *Diatraea saccharalis*, detailing particularly its damage to corn and giving new food-plants and remedies.

L. O. HOWARD. The Methods of Pupation among the *Chalcididæ*.

Insect Life, IV; double number 5 and 6, December, 1891, pp. 193–196.

L. O. HOWARD. The Habits of *Elasmus.*

Insect Life, IV, double number 7 and 8, March, 1892, pp. 253–254.

L. O. HOWARD. The Biology of the Hymenopterous Insects of the Family *Chalcididæ.*

Proc. U. S. Nat. Mus., XIV, pp. 567–588, excerpt No. 881. Published 1891.

A general consideration of the biology of the *Chalcididæ* under the following subheads: The insects and stages of insects infested by Chalcidids; How the Chalcidid larva lives; How fast does it develop?; How the larva transforms; How many develop in a single host?; Proportions of sexes in issuing; Phytophagic habit; Parthenogenesis; How large is the family?

L. O. HOWARD. The Habits of *Melittobia.*

Proc. Ent. Soc. Washington, II, No. 2, pp. 244–248. Issued June 30, 1892.

A résumé of the habits of the hymenopterous parasites belonging to this genus, with an account of the rearing of a species from a dipterous pupari. An appended table indicates the host insects, the species of parasite, and the name of the observer.

L. O. HOWARD. Appearance of Mealy Bugs parasitized by *Leptomastrix.*

Proc. Ent. Soc. Washington, II, No. 2, pp. 244–248. Issued June 30, 1892.

Careful description of these parasitized Mealy Bugs, indicating a striking resemblance to Dipterous puparia.

L. O. HOWARD and C. V. RILEY. (See under C. V. RILEY.)

OLIVER P. JENKINS and BARTON W. EVERMANN. (See under BARTON W. EVERMANN.)

DAVID STARR JORDAN. Relations of temperature to vertebræ among fishes.

Proc. U. S. Nat. Mus., XIV, pp. 107–120.

W. C. KENDALL, A. C. ADAMS and. (See under A. C. ADAMS.)

F. H. KNOWLTON. Directions for collecting Recent and Fossil Plants.

Bull. U. S. Nat. Mus., No. 39, Part B, pp. [1]–[46].

Contains explicit directions for making collections of recent and fossil plants.

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* Notice of this paper was inadvertently omitted from the bibliography in the report for 1889.

F. H. Knowlton. The Flora of the Dakota Group. A posthumous work by Leo Lesquereux. Edited by F. H. Knowlton.

Monograph XVII, *U. S. Geological Survey*, pp. 1-400, pl. LXVI.

This monograph contains descriptions of 460 species of plants, and represents one of the best known fossil floras of the world.

S. R. Koehler. Museum of Fine Arts, Print Department: Exhibition illustrating the technical methods of the reproductive arts, from the fifteenth century to the present time, with special reference to the photo-mechanical processes. January 8 to March 6, 1892. Boston: Printed for the Museum by Alfred Mudge & Son. 24 Franklin street, 1892, XI + 98, 16mo.

A descriptive catalogue, giving a concise historical and technical account of all the reproductive processes of which specimens were shown.

S. R. Koehler. Report on the Section of Graphic Arts in the U. S. National Museum, 1889.

Report of the Smithsonian Institution (U. S. National Museum), 1889 (1891), pp. 301-315.

Leo Lesquereux. (See under F. H. Knowlton.)

Edwin Linton. Notes on entozoa of marine fishes, with descriptions of new species. Part III.

Rept. U. S. Commr. of Fish and Fisheries, 1888 (1891), pp. 223-542, pls. LIII-LX.

Notes on the genus *Echinorynchus*, with descriptions of four new species: *E. thecatus*, *attenuatus*, *serrani*, and *carchariæ*.

Edwin Linton. The anatomy of *Thysanocephalum crispum*, Linton, a parasite of the tiger shark.

Rept. U. S. Commr. of Fish and Fisheries, 1888 (1891), pp. 543-556, pls. LXI-LXVII.

Edwin Linton. On two species of larval *Dibothria* from the Yellowstone National Park.

Bull. U. S. Fish. Com., IX, 1889, (1891), pp. 65-79, pls. XXIII-XXVII.

Tigula catostomi, sp. nov., and *Dibothrium cordiceps*, Leidy, internal parasites of fish, collected by Dr. David S. Jordan for the Fish Commission.

Edwin Linton. Notes on avian entozoa.

Proc. U. S. Nat. Mus., XV, pp. 87-113, pls. IV-VIII, 1892.

The greater part of the material on which this paper was based was collected by the author in the Yellowstone National Park, in the interests of the U. S. Fish Commission, during an investigation of the parasitism of trout, and a search for the final host of the entozoa. Additional specimens were collected by Mr. P. L. Jouy, at Guaymas, Mexico.

One new genus, *Epision*, and eight new species are described, as follows: *Filaria serrata*, *Echinorynchus rectus*, *Distomum* (?) *verrucosum*, *D. flexum*, *Dibothrium exile*, *Epision plicatus*, *Tænia macrocantha*, and *T. compressa*.

Leverett M. Loomis. June birds of Cæsar's Head, South Carolina.

The Auk, VIII, No. 4, October, 1891, pp. 323-333.

Annotated list of 52 species.

Frederic A. Lucas. Animals recently extinct or threatened with extermination, as represented in the collection of the U. S. National Museum.

Report of the Smithsonian Institution (U. S. National Museum), 1889 (1891), pp. 609-649, pls. XCV-CV.

An account of some of the larger or more interesting species of animals that have become extinct within historic times, or are threatened with extinction, giving the reasons for their decrease.

Frederic A. Lucas. On the structure of the tongue in humming birds.

Proc. U. S. Nat. Mus., XIV, 1891, pp. 169-172, Pl. IV, 2 text figs.

Frederic A. Lucas. Notes on the preparation of rough skeletons.

Bull. U. S. Nat. Mus., No. 39, Part C, pp. [1]-[11], 12 text figures. Published August, 1891.

Full directions for collecting skeletons, with notes on proper methods of packing, etc.

Frederic A. Lucas. Explorations in Newfoundland and Labrador in 1887, made in connection with the cruise of the U. S. Fish Commission schooner *Grampus*.

Report of the Smithsonian Institution (U. S. National Museum), 1889 (1891), pp. 709-728.

C. L. Marlatt and **Charles V. Riley.** (See under Charles V. Riley.)

Otis T. Mason. Aboriginal skin-dressing. A study based on the material in the U. S. National Museum.

Report of the Smithsonian Institution (U. S. National Museum), 1889 (1891), pp. 553-589, pls. LXI-XCIII.

OTIS T. MASON. Report on the Department of Ethnology in the U. S. National Museum, 1889.

Report of the Smithsonian Institution (U. S. National Museum), 1889 (1891), pp. 281-288.

R. MACFARLANE. Notes on and list of birds and eggs collected in Arctic America, 1861-1866.

Proc. U. S. Nat. Mus., XIV, No. 865, October 19, 1891, pp. 413-446.

A well annotated list of 131 species.

C. HART MERRIAM. The dwarf screech owl (*Megascops flammeolus idahoensis* Merriam).

The Auk, IX, No. 2, April, 1892, pp. 169-171, pl. II.

GEORGE PERKINS MERRILL. [Notes on microscopic structure of some Hawaiian lavas.]

Report of the U. S. Coast and Geodetic Survey, Appendix 14, 1888 (1890), pp. 529, 530.

GEORGE PERKINS MERRILL. Stones for building and decoration. Wiley & Sons, New York, 1891, 8 vo., 450 pp., with 11 full-page plates and 18 figures in text.

This work treats of matters of especial interest to architects and engineers, but the subject is so handled as to make it practically a manual on the subject of stones in relation to their use for constructive purposes.

The work opens with a brief chapter on the early history of stone working in the United States; this is followed in Part I by chapters on the geographical distribution of stone of various kinds in the United States; the minerals of building stones and the physical and chemical properties of such stones as are utilized for general construction and decorative purposes.

Part II is given up to a systematic description of rocks, quarries, and quarry regions. Each variety of stone is taken up in its turn, its composition, its origin, structure and general adaptability for any form of work discussed, and the resources of each state and territory described in alphabetical order. The subjects treated are as follows: (1) the Steatites or Soapstones; (2) the Serpentines or verd-antique Marbles; (3) Gypsum and Alabaster; (4) Limestone and Dolomites, both marbles and the common varieties; (5) the Minor Ornamental Stones; (6) the Granites; (7) the Porphyries or Porphyritic Felsites; (8) the Liparites; (9) the Syenites; (10) the Diabases, Gabbros, Melaphyrs, and Basalts; (11) the Diorites and Andesites; (12) the Gneisses and Schists; and (13) the Sandstones, Volcanic Tuffs, and Slates.

Part III treats of the methods of quarrying and working; the machines and implements used in stone working; the weathering of building stone; the selection of stone for building purposes, and the methods employed for the protection and preservation of stone from the ravages of time.

Part IV is made up of appendices, including extensive tables showing the qualities of stone as indicated by their crushing strength, weight, ratio of absorption, and chemical composition; a short table on the prices of stone and the relative cost of dressing; a list of some of the more important stone buildings in the United States, and the dates of their erection; a bibliography of works on building stone; and concludes with a glossary of terms.

GEORGE PERKINS MERRILL. The wind as a factor in Geology.

The Engineering Magazine, February, 1892, 12 pp. and 7 illustrations.

In this paper the writer aims to show in a semipopular way some of the more interesting and striking geological results produced by wind as an abrading and transporting agent.

GEORGE PERKINS MERRILL. A marble quarry.

St. Nicholas, August, 1891, 2 pp., 2 illustrations.

A brief popular account of a marble quarry in northern Vermont.

GEORGE PERKINS MERRILL and R. L. PACKARD. On an azure blue pyroxenic rock from the middle Gila, New Mexico.

Describes the chemical and physical properties of a peculiar granular blue pyroxenic rock found in nodular masses in a metamorphic limestone occurring in one of the side cañons of the Gila River some forty miles west of Silver City, N. Mex.

GEORGE PERKINS MERRILL.

Notes on some North Carolina building and ornamental stones. *Stone*, IV, No. III, July, 1891. pp. 77-79.

Some errors of the Eleventh Census. *Stone*, Vol. IV, No. III, July, 1891, p. 92.

Notes on some new marbles. *Stone*, Vol. IV, No. IV, August, 1891, pp. 109, 110.

A suggestion. *Stone*, Vol. IV, No. IV, August, 1891, p. 114.

Relative abundance of the elements. *Stone*, Vol. IV, No. V, September, 1891, pp. 137, 138.

Foreign *vs.* American Marbles. *Stone*, Vol. IV, No. VI, October, 1891, p. 172.

Our sources of tin. *Stone*, Vol. IV, No. VII, November, 1891, pp. 212-214.

GEORGE PERKINS MERRILL—Continued.

Aluminum. *Stone*, Vol. IV, No. VIII, December, 1891, p. 330.

Concerning the Arizona onyx. *Stone*, Vol. IV, No. VIII, December, 1891, pp. 345, 346.

North America in Tertiary times. *Stone*, Vol. IV, No. IX, January, 1892, pp. 369, 370.

Persian onyx. *Stone*, Vol. IV, No. IX, January, 1892, p. 372.

Cave marbles. *Stone*, Vol. IV, No. X, February, 1892, pp. 398, 399.

Baryte. *Stone*, Vol. IV, No. X, February, 1892, p. 404.

A lesson from the Eleventh Census. *Stone*, Vol. IV, No. XI, March, 1892, pp. 432, 433.

Some Montana building stones. *Stone*, Vol. IV, No. XI, March, 1892, p. 453.

The micas. *Stone*, Vol. IV, No. XIII, May, 1892, p. 505.

R. L. PACKARD, GEORGE P. MERRILL and. (See under GEORGE PERKINS MERRILL.)

HENRY A. PILSBRY. Preliminary notices of new forms of fresh-water mollusks.

The Nautilus, V, pp. 142, 143, April, 1892.

Describes *Fluminicola Merriama* Pilsbry and Beecher, from a specimen furnished by the U. S. National Museum.

MARY J. RATHBUN. List of crustacea (collected in Texas by B. W. Evermann).

Report of the Commissioner of Fish and Fisheries respecting the Establishment of Fish-Cultural Stations in the Rocky Mountain Region and Gulf States. Fifty-second Congress, First Session, Senate Mis. Doc. No. 65, pp. 87, 88, 1892.

The crustacea, of which a list is given in this paper, were collected by Prof. B. W. Evermann during the months of November and December, 1891, while engaged in an investigation of the fresh and salt waters of eastern Texas, with a view to the establishment of a hatchery. Eighteen species are given, none of which are new.

MARY J. RATHBUN, JAMES E. BENEDICT and. (See under JAMES E. BENEDICT.)

RICHARD RATHBUN. Jerome Henry Kidder. A notice prepared for the Philosophical Society of Washington.

Bull. Philos. Soc., XI, pp. 480–488, 1891.

RICHARD RATHBUN. The United States Fish Commission. Some of its work.

The Century Magazine, March, 1892, pp. 679–697.

ROBERT RIDGWAY. Description of a new species of Whippoorwill from Costa Rica.

Proc. U. S. Nat. Mus., XIV, No. 867, October 19, 1891, pp. 465, 466.

Antrostomus rufomaculatus, p. 465.

ROBERT RIDGWAY. Notes on some birds from the interior of Honduras.

Proc. U. S. Nat. Mus., XIV, No. 868, October 26, 1891, pp. 467–471.

Based on a collection obtained from Mr. Erich Wittkugel. *Platypsaris aglaiæ hypophæus* (p. 467), and *Pithys bicolor olivascens* (p. 469), are described as new subspecies. A list of the geographical races of *Platypsaris aglaiæ* (6 in number) is given (p. 469); the female and young male of *Gymnocichla chiroleuca guatemalensis* Prevost are described for the first time (pp. 469, 470), and a list of 13 species new to the fauna of Honduras given (pp. 470, 471).

ROBERT RIDGWAY. Notes on some Costa Rican birds.

Proc. U. S. Nat. Mus., Vol. XIV, No. 869, November 2, 1891, pp. 473–478.

Platypsaris aglaiæ obscurus (p. 474) and *Scytalopus argentifrons* (p. 475) are described as new; young of *Oreothlypis gutturalis* (Cab.) and *Eucometis cassini* (Lawr.) are for the first time described. Other species noted critically are, *Mimus gilvus* (Vieill), (p. 473); *Picolaptes gracilis* Ridg. (proven to be the young of *P. compressus*), (p. 475); *Chloronerpes caboti* (Malh.), immature male described (p. 476); *Trogon massena* Gould (pp. 476–478); *Trogon aurantiiventris* Gould (p. 478), and *Accipita subniger* (Vieill). (From Greytown, Nicaragua.)

ROBERT RIDGWAY. Note on *Pachyrhamphus albinucha* Burmeister.

Proc. U. S. Nat. Mus., Vol. XIV, No. 870, October 26, 1891, pp. 479, 480.

A long-lost species, described seventeen years before, discovered in the National Museum collection. Not being referable to the genus *Pachyrhamphus*, or any other known generic type, the new generic name *Xenopsaris* was proposed for it.

ROBERT RIDGWAY. Description of two supposed new forms of *Thamnophilus*.

Proc. U. S. Nat. Mus., XIV, No. 871, October 26, 1891, p. 481.

Thamnophilus albicrissus and *Thamnophilus trinitatus*, both from the Island of Trinidad.

ROBERT RIDGWAY. List of birds collected on the Bahama Islands by the naturalist of the Fish Commission steamer *Albatross*. (Published by permission of the Commissioner of Fisheries.)

The Auk, VIII, No. 4, October, 1891, pp. 333–339.

The list is subdivided according to localities, as follows: I, Abaco, [illegible]0 species; II, New Providence, 34 species; III, Eleuthera Island, 18 species; IV, Cat Island, 15 species; V, Thattlings Island, 28 species; VI, Rum Bay, 27 species; VII, Green Bay, 26 species; VIII

ROBERT RIDGWAY—Continued.

Concepcion Island, 13 species; IX, Booby Rock, near Green Bay, 1 species; X, at sea, 3 species.

A considerable number of references and critical remarks accompany the lists.

ROBERT RIDGWAY. Description of a new sharp-tailed Sparrow from California.

Proc. U. S. Nat. Mus., XIV, No. 872, October 26, 1891, pp. 483, 484.

Ammodramus caudacutus becki, p. 483.

ROBERT RIDGWAY. Notes on the Genus *Sittasomus* of Swainson.

Proc. U. S. Nat. Mus., XIV, No. 877, November 2, 1891, pp. 507–510.

A critical review of the birds of this genus, which have been very imperfectly understood. The three recognized species were supplemented by four additional ones, as follows: *S. chapadensis*, new species (p. 509) from Chapado, Matto Grosso, Brazil: *S. amazonus* Lafr., restored; *S. æquatorialis*, new species (p. 509) from western Equador; *S. griseus* Jard., restored.

CHARLES V. RILEY. (The Gas Treatment Patent.)

Pacific Rural Press, July 25, 1891, and September 19, 1891.

History of the invention of the hydrocyanic acid gas treatment for scale-insects; proofs that the discovery was made and perfected by an agent of the U. S. Department of Agriculture, under direction of the author, and that the patent granted to Californian parties was wrongfully obtained; advises orange-growers not to heed it.

CHARLES V. RILEY. Report on the Department of Insects in the U. S. National Museum, 1889.

Report of the National Museum, 1888–'89, pp. 377–380. Also, separate, Washington, Government Printing Office, 1891.

Report of the Honorary Curator on the accessions to and the work done in the Department of Insects of the U. S. National Museum during the fiscal year 1888–'89. Also ennumerations of works published by various authors during the same time, and based either entirely or partially upon the material in the Museum.

CHARLES V. RILEY. Death of two noted Entomologists.

Scientific American, 65, No. 5, August 1, 1891.

Biographical note on the late Mr. Henry Edwards, his contributions to entomological science and his collection; explanation of the report of the death (subsequently proven to be erroneous) of the French entomologist, Mons. J. Künckel d'Herculais.

CHARLES V. RILEY. A viviparous Cockroach.

Insect Life, III, Nos. 11 and 12, August, 1891, pp. 443, 444, Figs. 32 and 33.

Further remarks on the viviparity of *Panchlora viridis* and the occasional occurrence of this Central American Blattid in the United States, in addition to article published in *Proc. Entom. Soc. Washington*, II, No. 1, May, 1881, p. 129. Figures of *P. viridis* in the young and adult stages.

CHARLES V. RILEY. The locust or "Grasshopper" outlook.

Scientific American, 65, September 26, 1891, p. 200.

Summary of investigations carried on by agents of the U. S. Department of Agriculture in 1891, to accertain the extent of damage done by various species of locusts in the West, and the condition of the swarms of these locusts in order to be able to make a forecast for 1892. The following species are more particularly treated: *Dissosteira longipinnis* from eastern and southeastern Colorado: *Caloptenus spretus* from North Dakota and Minnesota; *C. differentialis* from southwestern Kansas. Conclusions drawn from these investigations.

CHARLES V. RILEY. Mexican Jumping Beans and the plants upon which they are produced.

Amer. Garden, 12, September, 1891, pp. 552–554. Two text figures.

The Mexican Exphorbiaceous plants known to produce the "Jumping Beans" and previously referred to the genus *Colliguaja* prove to belong to the genus *Sebastiania*: diagnosis of the latter genus and synoptic table of three species (*S. bilocularis* Watson, *palmeri* Rose, n. sp., and *pringlei* Rose, n. sp.) prepared by Mr. J. N. Rose: Figures of *Carpocapsa saltitans* and of twig of *Sebastiania palmeri* with seed and other details.

CHARLES V. RILEY. How to get rid of English Sparrows.

Scientific American, 65, October 3, 1891, p. 213.

In reply to a query of a correspondent: The sparrows infesting a foundry can best be gotten rid of by poisoning with arsenic. Directions how to prepare and apply the poison.

CHARLES V. RILEY. Micro-organisms as Insecticides.

Scientific American Supplement, October 31, 1891, p. 13206.

Abstract of a paper read before Section F of the American Association for the Advancement of Science, August 22, 1891. The author gives a review of previous experiments in

CHARLES V. RILEY—Continued.

using micro-organisms in the dissemination of contagious diseases among injurious insects, and dwells upon the difficulties with which this subject is still surrounded.

CHARLES V. RILEY. Kerosene emulsion and *Pyrethrum*.

Insect Life, IV, Nos. 1 and 2, October, 1891, pp. 32, 33.

Short paper read before the Washington meeting of the Association of Economic Entomologists regarding the alleged difference between the emulsion consisting of kerosene extract of *pyrethrum* with soap and water and the emulsion prepared from an aqueous extract of *pyrethrum* with soap and kerosene. Adduces a communication from Prof. J. McNeill to the effect that there is practically no difference between the two emulsions.

CHARLES V. RILEY. List of the *Tineina* of Boreal America.

In the *"List of the Lepidoptera of Boreal America," by John B. Smith, Sc. D. Philadelphia: American Entomological Society,* October, 1891, p. 94. Also separate under above title.

A systematic enumeration of the Lepidopterous insects composing the superfamily *Tineina* hitherto described from North America. In a note (pp. 94, 95) the author points out the difficulties in preparing a satisfactory list of *Tineina* with our present state of knowledge of these insects. An "Addendum to the *Tineina*" (pp. 112–114) gives a generic synonymical reference list of many described species.

CHARLES V. RILEY. Government work and the Patent Office.

Insect Life, IV, Nos. 1 and 2, October, 1891, pp. 46, 47. Author's abstract of paper read at the Washington meeting of the Association of Economic Entomologists.

The author complains that valuable inventions and discoveries made by Government employés during investigations carried on by Government institutions can be appropriated and patented by outsiders upon mere legal technicalities. As an instance of this sort the gas treatment for scale insects is discussed.

CHARLES V. RILEY. A new herbarium pest.

Garden and Forest, IV, November 18, 1891, p. 543. Also in *Botanical Gazette*, December, 1891, pp. 334–337, 2 figs.

A reprint, with slight additions, from an article in *Insect Life*, IV, Nos. 3 and 4, pp. 108–113.

CHARLES V. RILEY. The imported Elm-Leaf Beetle. Its habits and natural history and means of counteracting its injuries.

U. S. Department of Agriculture, Division of Entomology, Bulletin No. 6 (second edition). Washington, Government Printing Office, October, 1891.

A reprint of the original edition published in 1885, with the addition of an appendix discussing the number of annual generations of *Galeruca xanthomelæna*, and Prof. J. B. Smith's experience with remedial measures for this pest.

CHARLES V. RILEY. On the Habits and Life History of *Diabrotica 12-punctata*.

Insect Life, IV, Nos. 3 and 4, November, 1891, pp. 104–108, fig. 5.

Summary of Prof. H. Garman's paper in *Psyche* on the Natural History of *12-punctata*; observations on the corn-feeding habits of the larva; breeding records to show that the species has at least two annual generations; polyphagous habits of the imago; description of the egg and larva, and preliminary note on parasites. Figures of the insect in all stages and mode of work.

CHARLES V. RILEY. A new Herbarium Pest (*Carphoxera* nov. gen., *ptelearia* n. sp.).

Insect Life, IV, Nos. 3 and 4, November, 1891, pp. 108–113, figs. 6–11.

Ravages of the larva of this Geometrid moth, apparently originating from Mexico or Lower California, in the Herbarium of the U. S. Department of Agriculture; enumeration of herbarium plants injured by larva; life-history of the species, and recommendations for its destruction; notes on other *Lepidoptera* known to feed in the larval state on dead and dry vegetation; technical description of *Carphoxera*, nov. gen. and *C. ptelearia* n. sp. in all stages, and of the pterogostic characters of the genus; also figures of the following Deltoid moths with their larva: *Helia æmula*, *H. americalis*, and *Xanthognatha minivalis*.

CHARLES V. RILEY. Further notes on *Panchlora*.

Insect Life, IV, Nos. 3 and 4, November, 1891, pp. 119, 120, fig. 12.

Description of the egg mass and of the individual egg of *Panchlora viridus*, and further evidence of the viviparity in this Blattid. Figure of the egg mass.

CHARLES V. RILEY. Scope and Importance of Entomology; Classification.

Boston Transcript, December 29, 1891.

Editorial abstract and notice of the first lecture on entomology given by C. V. Riley at the Lowell Institute, Boston, Mass.

CHARLES V. RILEY. Means of dealing with our insect foes. Insecticides and insecticide apparatus.

CHARLES V. RILEY—Continued.

Boston Transcript, January 2, 1892.

Editorial abstract of the second lecture on entomology given by C. V. Riley, at the Lowell Institute, Boston, Mass., December 31, 1891.

CHARLES V. RILEY. Natural checks to insect injury; insects of international concern.

Boston Transcript, January 5, 1892.

Editorial abstract of the third lecture on entomology given by C. V. Riley, at the Lowell Institute, Boston, Mass., January 4, 1892.

CHARLES V. RILEY. Little known facts about well known household pests.

Boston Transcript, January 8, 1892.

Editorial abstract of the fourth lecture on entomology given by C. V. Riley, at the Lowell Institute, Boston, Mass., January 7, 1892.

CHARLES V. RILEY. Organized Insect Societies.

Boston Transcript, January 12, 1892.

Editorial abstract of the fifth lecture on entomology by C. V. Riley, given at the Lowell Institute, Boston, Mass., January 11, 1892. The economy and social life of the honey bee, and the ant, and social wasps, were explained as the basis for a discourse on the development of intellect and reason in insects, the author finding that as in man the higher intellectual development and social organization have resulted from the long period of infantile dependence; so in these insects the long period of larval dependence may be considered the primary cause of their high intelligence and organization among insects.

CHARLES V. RILEY. Galls and Gall-insects: Caprification: Parasitism.

Boston Transcript, January 15, 1892.

Editorial abstract of the sixth lecture on entomology by C. V. Riley, given at the Lowell Institute, Boston, Mass., January 14, 1892.

CHARLES V. RILEY. Our Shade Tree Defoliators.

Boston Transcript, January 19, 1892.

Editorial abstract of the seventh lecture on entomology by C. V. Riley, given at the Lowell Institute, Boston, Mass., January 18, 1892.

CHARLES V. RILEY. The Interrelation of Plants and Insects.

Boston Transcript, January 22, 1892.

Editorial abstract of the eighth lecture on entomology by C. V. Riley, given at the Lowell Institute, Boston, Mass., January 21, 1892.

CHARLES V. RILEY. The Gypsy Moth.

Boston Commonwealth, January 23, 1892.

Full text of the second part of C. V. Riley's seventh lecture on Entomology, given at the Lowell Institute, Boston, Mass., January 19, 1892. Important points in the natural history of the imported Gypsy Moth (*Ocneria dispar*). Review of the means adopted in Massachusetts by the State authorities for the eradication of the insects; insufficiency and futility of the work hitherto done; suggestions of measures to be adopted; the probable future course of the insect.

CHARLES V. RILEY. Late experience in dealing with insects injurious to fruit.

Boston Transcript, January 26, 1892.

Editorial abstract of a lecture on the above subject given before the Massachusetts Horticultural Society, Boston, Mass., January 23, 1892. The following topics were discussed: The Plum Curculio, its natural history and the arsenical poisons as a remedy against it; recent results as to the value of various arsenical mixtures in spraying orchard trees; combined Insecticides and Fungicides; the Hydrocyanic acid gas treatment; Resin Washes; the Fluted Scale, and the importation of *Vedalia cardinalis*; some new insect enemies to fruit; the Apple Maggot; danger of the possible introduction of some foreign fruit insects; conclusion.

CHARLES V. RILEY. Reports of observations and experiments in the practical work of the division, made under the direction of the entomologist.

U. S. Department of Agriculture, Division of Entomology, Bulletin No. 26, Washington, Government Printing Office, January, 1892.

Contains the following: Letter of transmittal by C. V. Riley, p. 5; Introduction, pp. 7, 8; report upon insect depredations in Nebraska for 1891, by Lawrence Bruner, pp. 9–12; report on the scale insects of California, by D. W. Coquillet, pp. 13–35; entomological notes for the season of 1891, by Mary E. Murtfeldt, pp. 36–44; report of progress in the investigation of the Cotton Bollworm, by F. W. Mally, pp. 45–56; insects of the season in Iowa, by Herbert Osborn, pp. 57–62; report of entomological work of the season of 1891, by F. M. Webster, pp. 63–74; report upon the Gypsy Moth of Massachusetts, by Samuel Henshaw, pp. 75–82; report of Agricultural Experiments in 1891, by A. J. Cook, pp. 83-92.

Charles V. Riley. Reports on the damage by Destructive Locusts during the season of 1891. Made under the direction of the Entomologist.

U. S. Department of Agriculture, Division of Entomology, Bulletin No. 27, Washington, Government Printing Office, January, 1892.

Contains the following: Letter of transmittal, by C. V. Riley, p. 5; Introduction, by C. V. Riley, p. 7; report on Destructive Locusts, by Lawrence Bruner (including reports of C. B. Waldron, H. E. Stockbridge, and Otto Lugger, the latter report being a reprint from Bulletin No. 17, Minnesota Agricultural Experiment Station), pp. 9–33; report on the Locust Invasion of California in 1891, by D. W. Coquillet, pp. 34–57; report of a trip to Kansas to investigate reported damages from grasshoppers, by Herbert Osborn (reprinted from *Insect Life*, IV, p. 49), pp. 58–64.

Charles V. Riley. Applied Entomology in the United States.

American Agriculturist, LI, January 1892, p. 38.

Importance assumed by economic entomology in the United States, and outline of its history; enumeration of injurious insects of national importance that have of late years been thoroughly studied; brief review of the more recently discovered insecticides and insecticide appliances; use of contagious disease germs in entomology; outlook of the science in the future.

Charles V. Riley. Flowers and insects.

Daily Eagle, Brooklyn, N. Y., February 3, 1892.

Full editorial abstract of a lecture given by C. V. Riley before the Brooklyn Institute at Brooklyn, N. Y., February 2, 1892. Fertilization of flowering plants by insects, and mutual adaptation in the structure of flowers and insects; fertilization of *Yucca* by *Pronuba* insectivorous plants; generalizations and conclusions.

Charles V. Riley. The Plum Curculio, an American insect.

California Orchard and Farm, March, 1892.

Evidence to prove that *Conotrachelus nenuphar* is a native of North America, and that its reported occurrence in Europe and the assertion of its European origin are unfounded; enumeration of European *Curculionidæ* which infest stone fruit and which are liable to be mistaken for the Plum Curculio.

Charles V. Riley. Leaf-cutting ants.

Scientific American, April 2, 1892.

In reply to inquiry from a correspondent in Texas relating to a remedy for the leaf-cutting ant (*Oecodoma fervens*). Description of the nest of the ants and various means for exterminating the inhabitants; experience with cyanide of potassium as a remedy.

Charles V. Riley. The larger digger wasp.

Insect Life, IV, Nos. 7 and 8, April, 1892, pp. 248–252, Figs. 32–38.

Sphecius speciosus as an enemy of *Cicada pruinosa;* its mode of attacking and paralyzing the *Cicada;* remarkable effect of the sting of fossorial wasps; rapid development of the larva; spinning of the cocoon; curious pores of the cocoon; hibernation and pupation. Original figures of *speciosus* in all stages, also figures of its burrows, mode of carrying a *Cicada*, mode of feeding of the larva, and the spinning of the cocoon.

Charles V. Riley. Speech of Prof. C. V. Riley.

Reprinted from the *Third Report on the Missouri Botanical Garden*, for 1891, May, 1892, pp. 50–53.

Speech delivered at the second banquet of the trustees of the Missouri Botanical Garden and eulogizing the late Mr. Henry Shaw, and the work which he did for St. Louis, Mo. Connection of entomology with the garden. Need of a national botanic garden.

Charles V. Riley. The Yucca Moth and Yucca Pollination.

Third Annual Report of the Missouri Botanical Garden, 1891, St. Louis, Mo., May, 1892, pp. 99–158, pls. XXXIV–XLIII. Also separate author's copies issued May 28, 1892.

Part I of the paper deals with the pollination of *Yucca* by *Pronuba* and contains the following chapters: Introductory: fertilization of plants generally; connection of *Yucca* and *Pronuba;* structural characteristics of *Pronuba;* the acts of pollination and oviposition; development of the egg and larva; transformations of *Pronuba*; effect of puncture on the fruit; effect of fertilization on the stalk; dates of the flowering of *Yuccas* and appearance of the moth; *Pronuba* the only insect pollinizer; general considerations; the bogus *Yucca* moth. Part II is devoted to descriptive details and contains the following headings: Internal structure of *Pronuba yuccasella* with reference to the reproductive organs; the ovipositor; the species of *Pronuba* and generic characters of *Pronuba;* the species of *Roddoxus*. The following species are described as new: *Pronuba synthetica*, *Prodoxus pulverulentus*, *Prodoxus y-inversus*, *Prodoxus reticulatus*, *Prodoxus coloardensis*, *Prodoxus sordidus*. The plates contain many original figures illustrating anatomical or structural details of *Yuccas* and *Yucca* Moths.

CHARLES V. RILEY. Report of the Entomologist.

Report of the Secretary of Agriculture, 1891, Washington, Government Printing Office, 1892, with table of contents and index.

Contains the following: Introduction, pp. 231, 232; the work of the season, pp. 232-246; destructive Locusts, pp. 246-252; insecticides, pp. 252-266.

CHARLES V. RILEY. Note on the Life Habits of *Megilla maculata.*

Proceedings Entomological Society of Washington, II, No. 2, June 30, 1892, pp. 168, 169.

Vegetable-feeding habit of the adult; comparison of the larva with those of other *Coccinellidæ.*

CHARLES V. RILEY. On the larva and some peculiarities of the cocoon of *Sphecius speciosus.*

Proceedings Entomological Society of Washington, II, No. 2, June 30, 1892, pp. 170-172.

Description of the larva and cocoon of *Sphecius speciosus* and explanation of the tubes projecting from an opening on the exterior of the cocoon.

CHARLES V. RILEY. Mexican Jumping Beans. The determination of the plant.

Proceedings Entomological Society of Washington, II, No. 2, June 30, 1892, pp. 178-181.

The food-plant of *Carpocapsa saltitans* hitherto unknown excepting by popular name, or incorrectly referred to the genus *Colliguaja* belongs to the genus *Sebastiania*, of which three (undescribed) species were recently collected in Mexico. General characteristics of these plants and synoptic table, prepared by Mr. J. N. Rose, of the three species with diagnosis of the genus *Sebastiania*. Probable mode of oviposition in *Carpocapsa saltitans.*

CHARLES V. RILEY. On the insects affecting the *Agave.*

Proceedings Entomological Society of Washington, II, No. 2, June 30, 1892, pp. 210, 211.

Enumeration, with short notes, of six species of insects obtained from the flower-stems of *Agave dasylyrium*, from Texas.

CHARLES V. RILEY. A probable *Microgaster* parasite of *Eleodes* in the imago state.

Proceedings Entomological Society of Washington, II, No. 2, June 30, 1892, p. 211.

Enumeration of European species of *Apanteles*, bred from Coleoptera, and announcement of the discovery of a species apparently belonging to *Microgasterini*, the larva of which developed in the abdomen of an adult *Eleodes saturalis*, from Nebraska.

CHARLES V. RILEY. Our American Ox Warbles.

Proceedings Entomological Society of Washington, II, No. 2, June 30, 1892, pp. 212, 213.

Résumé of observations made in Europe, and establishing the specific distinction of *Hypoderma lineata* from *H. bovis;* proof that the North American "Heel-Fly" belongs to the former species. The occurrence of *H. bovis* in America is doubtful.

CHARLES V. RILEY. Further note on *Carpocapsa saltitans* and on a new *Grapholitha* producing Jumping-Beans.

Proceedings Entomological Society of Washington, II, No. 2, June 30, 1892, pp. 213, 214.

The moth bred from the capsules of *Sebastiania bilocularis* Watson, proves to be different from *Carpocapsa saltitans*, and is described as *Grapholitha sebastianiæ*, n. sp.

CHARLES V. RILEY. Fig insects in Mexico.

Proceedings Entomological Society of Washington, II, No. 2, June 30, 1892, pp. 214, 215.

Enumeration of Hymenopterous insects (4 forms) cut from a dried fruit of a *Ficus* from Mexico, all species proving to be different from the fig insects found in southern Florida.

CHARLES V. RILEY. The Ox Bot in the United States. Habits and natural history of *Hypoderma lineata.*

Insect Life, IV, Nos. 9 and 10, June, 1892, pp. 302-317, Figs. 44-55.

Proof that the American Ox Warble is *Hypoderma lineata*, and not *H. bovis;* Dr. Cooper Curtice's investigations of the life history of *H. lineata ;* mode of oviposition and characteristics of the egg; how the larva enters the body of the animal; migrations of the larva within the body of the cattle; its slow development, and the various forms assumed by it; differences between the larva of *H. bovis* and *H. lineata ;* description of the egg; the four states of the larva; the puparium and the imago; comparison of the imagos of the two species; summary and conclusions. The original figures illustrate all stages of *H. lineata.*

CHARLES V. RILEY. The Yucca Moth and Yucca pollination.

Popular Science Monthly, XLI, June, 1892, pp. 171-182, 10 figs.

A reprint, with omissions, from the first part of paper published in *Third Annual Report Missouri Botanical Garden*, 1892, pp. 99-158.

CHARLES V. RILEY. Directions for collecting and preserving insects.

Bulletin of the U. S. National Museum, No. 39, Part F, pp. [1]-[147], pl. I, 139 text figures.

CHARLES V. RILEY—Continued.

The subject is treated after the following scheme: Characteristics of insects; scope and importance of entomology; classification of *Hexapods*; collecting; killing and preserving insects; *entomotaxy;* insect boxes and cabinets; arrangement of insects in the cabinet; museum pests, mold, etc.: the rearing of insects; directions for packing and transmitting insects; notes and memoranda; instructions for collecting and preserving *Arachnids* and *Myriapods*; text-books and entomological works; how to obtain entomological books and pamphlets.

CHARLES V. RILEY and L. O. HOWARD. The three pear tree *Psyllas*.

Insect Life, IV, Nos. 3 and 4, November, 1891, pp. 127, 128.

Abstract of a paper by Dr. F. Loew, pointing out the differences in life habits of the three specimens of *Psylla* (*Ps. pyrisuga*, *Ps. pyri*, and *Ps. Pyricola*) known to infest pear trees in Germany and Austria, with a synoptic table of the structural characters. Also characteristics of a fourth species, *Ps. simulans*, which has been found in England on pear trees.

CHARLES V. RILEY and L. O. HOWARD. An interesting aquatic bug.

Insect Life, IV, Nos. 5 and 6, December, 1891, pp. 198–200, Fig. 22.

Original figure and characteristics of a remarkable North American aquatic *Heteropteron* assigned to the family *Hydrobatidæ*, and most nearly related to the genus *Metrobates*. Subsequently (l. c., Nos. 9 and 10, June, 1892, p 321) Dr. E. Bergroth named the insect *Rheumatobates rileyi*.

CHARLES V. RILEY and L. O. HOWARD. The Potato-Tuber Moth. (*Lita solanella* Boisd.)

Insect Life, IV, Nos. 7 and 8. April, 1892, pp. 239–242, Fig. 27.

Ravages of *Lita solanella* in New Zealand, Tasmania and Australia; Mr. Tryon's account of its habits and life-history; appearance of the insect in California in 1891; suggestion of preventive measures; figures of the insect in all states, and mode of work of the larva in a potato.

CHARLES V. RILEY and L. O. HOWARD. A genus of *Mantis*. Egg parasites.

Insect Life, IV, Nos. 7 and 8, April, 1892, pp. 242–245, Figs. 28–31.

Wide geographical distribution and specific richness of the Chalcidid genus *Podagrion*, which lives parasitically in the eggs of Mantids: history and systematic position of *Podagrion*; arrangement of the individual eggs in the egg-mass of *Stagmomantis carolina*, and of an unnamed Australian Mantid; mode of issuing of the young Mantids and the parasites from the egg-mass; figures of *Podagrion mantis*, egg-mass of *Stagmomantis carolina;* cross-section of the same, and of the egg-mass of an Australian Mantid.

CHARLES V. RILEY and L. O. HOWARD. The Pea and Bean Weevils.

Insect Life, IV, Nos. 9 and 10, June, 1892, pp. 297–302, Figs. 40–43.

Résumé of the life history of *Bruchus pisi*, and evidence as to whether the larva destroys the germ of the pea; natural history of *Bruchus fabæ*, and points wherein it differs from that of *B. pisi;* description of the first larva of *B. fabæ*, the most remarkable character being the temporary legs. Figures of both species of *Bruchus*, and original figure of the first larva of *B. fabæ*.

CHARLES V. RILEY and L. O. HOWARD. The Locust and Grasshopper Outlook.

Insect Life, IV, Nos. 9 and 10, June, 1892, pp. 321–323.

Mainly a reproduction of a paper read before Section I of the American Association for the Advancement of Science, at the Washington meeting (August, 1891) regarding the injury done by grasshoppers, and the movements of the migratory species in various parts of the United States in 1891.

CHARLES V. RILEY and L. O. HOWARD. Some *Icerya* and *Vedalia* notes.

Insect Life, III. Nos. 11 and 12, August, 1891, pp. 439–441, Fig. 31.

Perfected figures of the Australian Ladybird, *Vedalia cardinalis*, in the larva, pupa, and imago states. Account of the attempts to transport living *Vedalias* from California to the Cape Colony, New Zealand, and Egypt.

CHARLES V. RILEY and L. O. HOWARD. Experiments with a Date-Palm Scale.

Insect Life, III, Nos. 11 and 12, August, 1891, pp. 441–443.

A number of date-palm trees received in 1890 by the U. S. Department of Agriculture from northern Africa with a view to establish them in California proved to be badly infested with a scale, *Parlatoria zizyphi*. After often repeated treatment with kerosene emulsions of various strengths the scales were finally exterminated without injury to the trees.

CHARLES V. RILEY and L. O. HOWARD. Some of the bred parasitic *Hymenoptera* in the National Collection.

Insect Life, III, Nos. 11 and 12, August, 1891, pp. 460–464.

Systematic enumeration of the rearings of North American parasitic Hymenoptera of the families *Ichneumonidæ* (subfamilies *Tryphoninæ*, *Pimplinæ*, and *Trigonalidæ*.) Continued from *Insect Life*, III, No. 4, November, 1890, p. 158.

CHARLES V. RILEY and L. O. HOWARD. Some of the bred parasitic *Hymenoptera* in the National Collection.

Insect Life, IV, Nos. 3 and 4, November, 1891, pp. 122-126.

Continuation of paper in *Insect Life*, III, Nos. 11 and 12, August, 1891, p. 464, and covering the family *Proctotrypidæ* (subfamilies *Bethylinæ*, *Dryininæ*, *Spalangiinæ*, *Ceraphroninæ*, *Scelioninæ*, *Platygostorinæ*, *Proctotrypinæ*, and *Diapriinæ*).

CHARLES V. RILEY and L. O. HOWARD. (Editorials, reviews, and notes.)

Insect Life, III, Nos. 11 and 12, August, 1891, and IV, Nos. 1-10, October, 1891, to June, 1892.

See table of contents of each number of *Insect Life*.

CHARLES V. RILEY and L. O. HOWARD. (Correspondence of the Division of Entomology, U. S. Department of Agriculture.)

Insect Life, III, Nos. 11 and 12, August, 1891, and IV, Nos. 1-10, October, 1891, to June, 1892.

Selected letters from correspondents with the replies.

CHARLES V. RILEY and C. L. MARLATT. Wheat and Grass Sawflies.

Insect Life, IV, Nos. 5 and 6, December, 1891, pp. 168-179, Figs. 13-15.

Review of previous records of Saw fly larva feeding on graminaceous plants; food habits of European species of *Dolerus*; general characteristics of *Dolerus* larva and distinguishing characters of the various forms observed in North America, with notes on their food habits; life history of *Nematus marylandicus* with characteristics of the earlier stages; food habits of a California species of Cephus which is described as *C. occidentalis* n. sp.; notes on the parasites of wheat saw flies, and on remedial measures; original figure of *Dolerus arvensis*; *Nematus marylandicus*, in all stages, and *Cephus occidentalis* larva, its mode of work, and female imago.

J. N. ROSE. Notes on *Asclepias glaucescens* and *A. elata*.

Botanical Gazette, XVII, June, 1892, pp. 193, 194.

These two species have generally been considered one and the same species, but it is here shown that there are good characteristics by which they can be separated.

J. N. ROSE. Two weeds new to the United States.

Report of the Secretary of Agriculture, 1891, pp. 355-358, pls. 2.

Descriptions and remarks upon *Orabanche ramosa* and *Salsola Kali* var. *Tragus* are given. Both are figured.

E. A. SCHNEIDER and F. W. CLARKE. (See under F. W. CLARKE.)

R. W. SHUFELDT. On the external characters of Fœtal Reindeer and other notes.

Proceedings of the Academy of Natural Sciences of Philadelphia, July, 1891, pp. 224-233. Four wood-cuts in text.

An anatomical article based upon a male and female fœtus of the Reindeer, collected by Mr. L. M. Turner in Alaska, and now forming a part of the collection of spirit specimens of mammals in the National Museum.

R. W. SHUFELDT. A female *Piranga rubra* assuming the plumage of the male.

The Auk, VIII, No. 3, July, 1891, pp. 315, 316.

R. W. SHUFELDT. The collections of the late Prof. Parker, F. R. S.

Science, XVIII, No. 441, New York, July 17, 1891, pp. 39, 40.

Recommending their purchase by the U. S. National Museum.

R. W. SHUFELDT. Head-flattening as seen among the Navajo Indians.

The Popular Science Monthly, New York, August, 1891, XXXIX, No. 4, pp. 535-539, 3 figures in text.

To some extent dissenting from the views of Sir William Turner, F. R. S., as to the distortion of the cranium seen in these Indians being always due to the strapping of the infants in their cradles.

R. W. SHUFELDT. Contributions to the comparative osteology of Arctic and Subarctic Water-birds. Part IX.

Jour. of Anat. and Phys., Lond., XXV., n. s., V, pt. IV, art. 5, pls. XI, XII. London, July, 1891, pp. 509-525.

Full and comparative account of the skeletons of many water birds contained in the collections of the National Museum.

R. W. SHUFELDT. Where young amateur photographers can be of assistance to science.

The Amer. Naturalist, XXV, No. 295, Philadelphia, July, 1891, pp. 626-630, pl. XIII, fig. 1.

Illustrated by a plate of *Buteo borealis calurus*, and a figure of the Tiger Salamander (*A. tigrinum*); specimens now belonging to the collection of the National Museum.

R. W. SHUFELDT. Further notes on the anatomy of the *Heloderma*.

Nature, No. 1135, v. 44. London, July 30, 1891, pp. 294, 295.

R. W. SHUFELDT. Inspirational Archæology.

The Religio-Philosophical Journal. n. s., II, No. 14, Chicago, August 29, 1891, pp. 214–216, 3 figures in text.

Exposing Mr. Hudson Tuttle, who in *The Progressive Age* claims to have had the spirit of an Indian instruct him in the manufacture of Indian arrow-points, which Mr. Tuttle states to be a lost art. The present article makes a study of the archæological material in the Smithsonian Institution, and through it, refutes all that Mr. Tuttle has to say.

R. W. SHUFELDT. On the comparative osteology of the United States *Columbidæ.*

Proc. Zoöl. Soc. of Lond. Part 11, London, August 1, 1891, pp. 194–196.

A comparative description of the skeletons of the pigeons in the collections of the National Museum, together with remarks upon the classification of the *Columbidæ*, and their probable affinities.

R. W. SHUFELDT. Snake Dance of the Moquis.

The Great Divide, VI, No. 2, Denver, Colo., October, 1891, pp. 24, 25, 1 plate.

R. W. SHUFELDT. Fossil Birds from the Equus Beds of Oregon.

The American Naturalist, XXV, No. 297, Philadelphia, September, 1891, pp. 818–821.

Preliminary abstract of the complete work, which did not appear until October, 1892, in *The Journal of the Academy of Natural Sciences of Philadelphia.*

R. W. SHUFELDT. Tertiary Fossils of North American Birds.

The Auk, VIII, No. 4, New York, October, 1891, pp. 365–368. Abstract; see *supra.*

Alludes to many new species. Description of a very large collection of fossil birds from Oregon, belonging to Prof. E. D. Cope and Prof. Thos. Condon, of the Oregon University. Comparisons made with the entire collection of skeletons of existing birds in the National Museum, and with the fossil forms from Prof. A. C. Milne-Edwards of Paris.

R. W. SHUFELDT. Morphology of the Avian Brain.

The Amer. Nat., XXV, No. 298, Philadelphia, October, 1891, pp. 900, 901.

R. W. SHUFELDT. Indian Types of Beauty. No. 1.

The American Field, XXXVI, No. 23, New York and Chicago, December 5, 1891, pp. 544, 545, 2 figures in text.

The first of a series of three papers on this subject which originally appeared in the *American Field*, but was subsequently copied by a number of other magazines and journals. There were also 250 reprints of the combined articles republished and distributed, repaged, same title, heavy paper covers. The work gives full-page figures of Indian women selected from among the Navajos, Zuñians, Moquis, Apaches, Yumas, Mojaves, and other tribes, for their beauty, that is, women considered to be beautiful by the tribe to which, in any instance, they belonged. Comparative studies were made by the author of the ethnological material in the National Museum bearing upon this subject, especially in the matter of dress and ornaments used by Indians with the view of enhancing their native beauty.

R. W. SHUFELDT. Indian Types of Beauty. No. 2.

The American Field, No. 24, December 12, 1891, pp. 566, 567, 3 figures in text.

R. W. SHUFELDT. Some observations on the Havesu-pai Indians.

Proceedings U. S. National Museum, XIV, pp. 387–390, pls. XXV, XXVI, Washington, 1891.

Gives photographs of men, women, and children of this now nearly extinct tribe of Indians. The style of their houses is also shown, and the nature of the country where they now live.

R. W. SHUFELDT. The Navajo Belt-Weaver.

Ibid, pp. 391–393, pl. XXVII, Washington, 1891.

The plate shows a Navajo woman weaving a belt, the figure being taken from a photograph made by the author in New Mexico.

R. W. SHUFELDT. Indian Types of Beauty. No. 3.

The American Field, XXXVI, No. 25, New York and Chicago, December 19, 1891, pp. 590, 591; 3 figures in text.

The last of the series.

R. W. SHUFELDT. Concerning the taxonomy of the North American *Pygopodes*, based upon their osteology.

Jour. Anat. & Phys. (London), January, 1892, XXVI, pp. 199–203.

R. W. SHUFELDT and **E. D. COPE.** A contribution to the Vertebrate Paleontology of Texas.

Proc. Amer. Phil. Soc., XXX, April, 1892.

Dr. Shufeldt's share in this paper consists in his description of *Oreccoides osbornii* Shuf. gen. et sp. nov., on pp. 125–127. Based on a tarso-metatarsus of a fossil rail found by Prof. Cope in Texas. The species is dedicated to Prof. H. F. Osborn, of Columbia College, New York. Osteological collections of National Museum extensively used in comparison.

R. W. SHUFELDT. Indian Jewelers.

The Great Divide, VII, No. 3, Denver, Colo., May, 1892, p. 57, 2 figures in text.

Two figures given of Navajo silversmiths, with specimens of work, workshop, etc.

R. W. SHUFELDT. Indian types of Beauty.

The American Field, Chicago, May, 1892.

(250 copies: Reprints from XXXV, Nos. 23-25. Paper covers; title-page. Same title, pp. 24. 8 full-page plates.)

CHARLES TORREY SIMPSON. Notes on a collecting trip in Florida.

Forest and Stream, N. Y., XXXVIII, No. 5, p. 99, February 4, 1892.

CHARLES TORREY SIMPSON. Notes on *Unionidæ*.

The Nautilus, V, pp. 86-88, December, 1891.

These notes are principally devoted to the discussion of the mutual relations of *Unio radiatus* and *U. luteolus*.

R. E. C. STEARNS. Edible shell notes for "The Nautilus."

The Nautilus, V, No. 3, pp. 25, 26, July, 1891.

Discusses various edible mollusks of the West American coast.

R. E. C. STEARNS. In memoriam—Dr. Wesley Newcomb.

The Nautilus, V, No. 11, pp. 121-124, March, 1892.

R. E. C. STEARNS. List of North American land and fresh-water shells received from the U. S. Department of Agriculture, with notes and comments thereon.

Proc. U. S. Nat. Mus., XIV, No. 844, pp. 95-106, July, 1891.

This paper relates chiefly to land and fresh-water species collected in the western states and territories.

R. E. C. STEARNS. List of shells collected on the west coast of South America, principally between latitude 7° 30′ S. and 8° 49′ N., by Dr. W. H. Jones, Surgeon U. S. Navy.

Proc. U. S. Nat. Mus., XIV, No. 854, pp. 307-335, 1891.

This paper enumerates 211 species of marine shells, and the geographical distribution of many of them is shown to be greatly extended beyond that previously known for them.

LEONHARD STEJNEGER. Description of a new species of Chameleon from Kilima-Njaro, eastern Africa.

Proc. U. S. Nat. Mus., XIV, No. 857, pp. 353, 354.

Describes as a new species *Chamæleo abbotti*.

LEONHARD STEJNEGER. Description of a new Scincoid Lizard from East Africa.

Proc. U. S. Nat. Mus., XIV, No. 862, pp. 405, 406.

Describes as a new species *Lygosoma kilimensis*.

LEONHARD STEJNEGER. Description of a new species of lizard from the Island San Pedro Martir, Gulf of California.

Proc. U. S. Nat. Mus., XIV, No. 863, pp. 407, 408. Described as a new species *Cnemidophorus martyris*.

LEONHARD STEJNEGER. Description of a new North American Lizard of the genus *Sauromalus*.

Proc. U. S. Nat. Mus., XIV, No. 864, pp. 409-411.

Describes as a new species *Sauromalus hispidus*.

LEONHARD STEJNEGER. Notes on *Sceloporus variabilis* and its geographical distribution in the United States.

Proc. U. S. Nat. Mus., XIV, No. 873, pp. 485-488.

Shows it to occur over a considerable area of southwestern Texas.

LEONHARD STEJNEGER. Notes on some North American Snakes.

Proc. U. S. Nat. Mus., XIV, No. 876, pp. 501-505.

Chiefly relating to geographical distribution. Introduces on good evidence into the fauna of the United States *Drymobius margaritiferus*.

LEONHARD STEJNEGER. On the Snakes of the California genus *Lichanura*.

Proc. U. S. Nat. Mus., XIV, No. 878, pp. 511-515.

Recognizes and diagnoses three species, viz: *L. trivigata*, *roseofusca*, and *orcutti*.

LEONHARD STEJNEGER. Preliminary description of a new genus and species of Blind Cave Salamander from North America.

Proc. U. S. Nat. Mus., XV, No. 894, pp. 115-117, pl. IX.

Describes as a new genus and species *Typhlotriton spelæus*, from Rock House Cave, Mo.

LEONHARD STEJNEGER. Directions for collecting Reptiles and Batrachians.

Bull. U. S. Nat. Mus., No. 39, Part E, pp. [1]-[14], 5 text figs.

Leonhard Stejneger—Continued.

Brief directions for collecting, preserving, labelling, and transporting herpetological specimens, chiefly for the use of correspondents of the Museum.

Leonhard Stejneger. Annotated list of Reptiles and Batrachians collected by Dr. C. Hart Merriam and party, in Idaho, 1890.

North American Fauna, No. 5, July 30, 1891, pp. 109-113.

Leonhard Stejneger and **Frederick C. Test.** Description of a new genus and species of Tailless Batrachian from Tropical America.

Proc. U. S. Nat. Mus., XIV, No. 847, pp. 167, 168, pl. III.

Described as a new genus and species *Tatraprion jordani.*

Leonhard Stejneger. Notes on Japanese Birds contained in the Science College Museum, Imperial University, Tokio, Japan.

Proc. U. S. Nat. Mus., XIV, No. 874, pp. 489-497, October 26, 1891.

The following species are here for the first time introduced into the fauna of Japan: *Aestrelata leucoptera*, *Glareola orientalis*, *Tringa ferruginea*, *Phaëthon candidus*, *Ardea purpurea*, *Halcyon pileata*, *Turdus hortulorum*, *Emberiza leucocephala*, *E. pusilla*, and with some doubt, *Erithacus sibilans*, *Lanius sphenocercus*, and *Munia atricapilla.*

Leonhard Stejneger. Notes on the Cubital Coverts in the Birds of Paradise and Bower Birds.

Proc. U. S. Nat. Mus., XIV, No. 875, pp. 499, 500, October 29, 1891.

Controverts Prof. J. G. Goodchild's observation as to the abnormality of the arrangement of the cubital coverts in the Birds of Paradise and the Bower Birds, and shows it to be normally Passerine.

Leonhard Stejneger. Scott B. Wilson's "Aves Hawaiiensis."

The Auk, IX, January, 1892, pp. 63, 64.

Review.

Leonhard Stejneger. Capt. Thomas Wright Blackiston, R. A.

The Auk, IX, January, 1892, pp. 75, 76.

Obituary.

Witmer Stone. A Revision of the Species of *Molothrus* allied to *M. Bonariensis* (Gm.).

The Auk, VIII, No. 4, October, 1891, pp. 344-348.

An excellent and timely revision of a difficult group. One species, *M. venezuelensis* (p. 347), described as new.

Z. L. Tanner, U. S. Navy. Report on the investigations of the U. S. Fish Commission steamer *Albatross* for the year ending June 30, 1889.

Report U. S. Commissioner of Fish and Fisheries, 1889 (1891), pp. 395-512, pls. L-LII.

These investigations embraced the western coast of North America, from Alaska to Lower California, including the Gulf of California. In the text are many references to different forms of marine invertebrates which have not yet been separately reported upon.

Z. L. Tanner, U. S. Navy. The fishing grounds of Bristol Bay, Alaska. A preliminary report upon the investigations of the U. S. Fish Commission steamer *Albatross* during the summer of 1890.

Bull. U. S. Fish Com., IX, 1889 (1891), pp. 279-288, pls. CVIII-CX.

During the cruise above mentioned many valuable invertebrates were obtained which will in time be transferred to the National Museum.

Frederick C. Test, **Leonhard Stejneger** and. (See under **Leonhard Stejneger.**)

William J. Thomson. Te Pito Te Henua, or Easter Island.

Report of the Smithsonian Institution (U. S. National Museum), 1889 (1891), pp. 447-552, pls. XII-LX; 20 text figs.

Frederick W. True. The Puma, or American Lion: *Felis Concolor* of Linnæus.

Report of the Smithsonian Institution (U. S. National Museum), 1889 (1891), pp. 591-608, pl. XCIV.

Frederick W. True. Report on the Department of Mammals in the U. S. National Museum, 1889.

Report of the Smithsonian Institution (U. S. National Museum), 1889 (1891), pp. 349-355.

George Vasey. Report on the Department of Recent Plants in the National Museum, 1889 (1891).

Report of the Smithsonian Institution (U. S. National Museum), 1889 (1891), p. 399.

GEORGE VASEY. Grasses of the Southwest; plates and descriptions of the grasses of the desert region of western Texas, New Mexico, Arizona, and southern California.

Agricultural Department, Bulletin Division Botany, No. 12, Pt. 2, December, 1891, pl. 50.

Contains descriptions and figures of 50 rare grasses from the desert region of the Southwest.

GEORGE VASEY. Report of the botanist to the Secretary of Agriculture.

Report of the Secretary of Agriculture, 1891, pp. 341–358, pl. 10.

GEORGE VASEY. A new grass: *Melica multinerva.*

Botanical Gazette, August, 1891, pp. 235, 236.

GEORGE VASEY. A neglected *Spartina.*

Botanical Gazette, October, 1891, p. 272.

GEORGE VASEY. Monograph of the grasses of the United States and British America.

Contents National Herbarium, III, 1892, pp. 1-89.

This is the first part of a monograph of the grasses of North America north of Mexico.

CHARLES D. WALCOTT. Correlation papers, Cambrian.

Bulletin U. S. Geological Survey, No. 81, 1891, pp. 447, 3 double plates and 5 text figs.

This paper is an historical and descriptive work of the present knowledge of the Cambrian group of rocks of the North American continent. Chapter I gives a statement of the principles upon which the delineation of the group is made, with a few brief remarks upon the nomenclature of the formation and a list of the books and articles consulted in the preparation of the work. The second chapter contains a historical review of the geological and paleontological work that has been done in all provinces in which the Cambrian group occurs. Chapter III embraces a record of the names that have been employed to designate the various formations. Chapter IV gives a summary of the present knowledge of the formations in each of the four great geological provinces. A map showing the geographical distribution accompanies this chapter; also, one on which the sedimentation is illustrated by vertical columns of strata. Chapter V deals with problems for investigation, and Chapter VI is devoted to the study of criteria and principles used by authors in the correlation of the various parts composing the Cambrian group.

CHARLES D. WALCOTT. Preliminary notes on the discovery of a vertebrate fauna in Silurian (Ordovician) strata.

Bulletin Geol. Soc. Am., III, 1892, pp. 153–172, plates 3-5.

This is a preliminary description of the discovery of a vertebrate fauna in the lower Silurian (Ordovician) strata. It includes a description of the locality and the stratigraphy of the geologic section and its contained vertebrate fauna, and a description of three new genera and species of fishes.

LESTER F. WARD. The Science and Art of Government.

Science, XVIII, New York, November 20, 1891, p. 281.

Defines government as the business agency of the nation, and the science and art of government as those of conducting this business agency; hence lays stress on the importance of some system of instruction on these subjects as branches of education. Instruction in public administration and all governmental operations should form a prominent department of political economy teaching.

LESTER F. WARD. A national university, its character and purpose.

Science, XVIII, New York, November 20, 1891, pp. 281, 282.

Proposes a general plan for such an institution so as to make it truly representative in character, the leading chair to be that of political science, with special prominence attached to instruction in the science and art of government as outlined in the foregoing paper, all officers of the civil service to be ultimately selected from graduates of the national university.

This paper and the last were read before Section I (economics) of the American Association for the Advancement of Science, at Washington, D. C., August 20, 1891.

LESTER F. WARD. Principles and methods of geologic correlation by means of fossil plants.

Science, XVIII, New York, November 20, 1891, p. 282.

Abstract of a paper read before Section E (geology) of the American Association for the Advancement of Science, at Washington, D. C., August 21, 1891. The paper appeared in full in the *American Geologist* for February. 1891. See résumé under that date.

LESTER F. WARD. The Plant-bearing Deposits of the American Trias.

Science, XVIII, New York, November 20, 1891, p. 287, 288.

Abstract of a paper read by title before Section E (geology) of the American Association for the Advancement of Science, at Washington, D. C., August 21, 1891; and in full before the Geological Society of America at the same place, August 24, 1891. It was published in full in the Proceedings of the last named Society for that date. See *infra* for résumé of contents.

Lester F. Ward. Fossil Botany, being an Introduction to Palaeophytology from the Standpoint of the Botanist. By H. Graf zu Solms-Laubach. Authorized English translation by Henry E. F. Garnsey. Revised by Isaac Bayley.

Science, XVIII, New York, December 25, 1891, pp. 360, 361.

Review of the above work, in which it is compared with other works of its class, and is shown to be of chief use in recording the opinion of the author on the nature of problematical vegetable remains. The translation is severely criticised for not having been brought down to date, so that the author's latest decision in such cases could be known.

Lester F. Ward. On the Glossopteris Flora. Remarks on a paper read by Dr. August Rothpletz before the Geological Society at Washington, D. C., August 24, 1891, "On the Permian, Triassic, and Jurassic formations in the East Indian Archipelago."

Bulletin of the Geological Society of America, III, 1891, p. 15.

The view was taken that the Glossopteris flora originating in the Paleozoic contemporaneously with the recognized Carboniferous flora, unlike the latter, and by virtue of its higher organization, persisted into Mesozoic time, surviving the Permian refrigeration, and becoming modified, migrated northward, and reappeared at many points as the now well known Triassic Rhetic and Oölitic Flora.

Lester F. Ward. The Plant-bearing Deposits of the American Trias.

Bulletin of the Geological Society of America, III, 1891, pp. 23-31.

A critical analysis of the flora of the American Triassic deposits, with a view to their geologic correlation, both with one another and with those of other parts of the world. The facts establish the substantial identity in age of the several beds of the Atlantic slope and a close relation between these and those of New Mexico and Arizona; they also point to the European Keuper, as displayed in Austria, Wurtemburg and Switzerland, as the nearest homologue of the American Trias.

Lester F. Ward. Administrative Report to the Director of the U. S. Geological Survey for the year ending June 30, 1889.

Tenth Annual Report of the U. S. Geological Survey, 1888-'89, Washington, 1890, pp. 169-175. (Issued January, 1892.)

Lester F. Ward. Principles and methods of Geologic Correlation by means of Fossil Plants.

American Geologist, IX, Minneapolis, January, 1892, pp. 34-47.

The law of *homotaxis* is first explained, with a historical account of the introduction of the term. The leading principles laid down are: First, that the great types of vegetation are characteristic of the great epochs in geology, so that very imperfect material may establish such epochs with certainty; second, that for deposits nearly related stratigraphically such imperfect material is not adequate, but an ample series of good specimens is required; third, that the accurate determination and classification of fossil plants is of purely biological importance and not of geological importance. The methods employed in the determination of the age of plant-bearing deposits are set forth in considerable detail.

Lester F. Ward. Principes de Corrélation Géologique au Moyen des Plantes Fossiles.

Cinquième Congrès Géologique International, Washington, 1891. Procès-Verbaux des Séances Mercredi le 26 Août à Mardi le 1 Septembre, 1891. Washington, 1892, pp. 26, 27.

Brief summary of the part read before the International Geological Congress of a paper entitled "Principes et méthodes d'etude de la corrélation géologique au moyen des plantes fossiles," in which two of the principles were developed (see *supra* under date of August 28, 1891). The paper was read in French, and a summary furnished in English, of which this is a translation, made by Dr. S. F. Emmons. For contents of the entire paper see last entry.

Lester F. Ward. The utilitarian character of Dynamic Sociology.

American Anthropologist, Vol. v, Washington, April, 1892, pp. 97-103.

This article is a defense of the science of dynamic sociology as expounded in the work of that title against the charge of being a system of speculative philosophy devoid of practical bearing on living issues. It is directed primarily to establishing broad principles looking to the amelioration of the social condition, but does not claim to set forth any particular scheme of social reform, that part belonging rather to the art of dynamic politics than to the science of dynamic sociology. The general doctrine embodying these principles is that of *meliorism*, which differs from philanthropy and humanitarianism as popularly understood by proceeding according to the scientific method to establish the laws of social reorganization, such as will result in improving and reforming society.

Lester F. Ward. Ueber Tertiäpflanzen von Chile; von H. Engelhardt. Frankfort, 1891.

LESTER F. WARD—continued.

Amer. Journ. Sci., XLIII, New Haven, April, 1892, pp. 335, 336.

Notice of above memoir from *Abhandl. d. Senckbergischen naturf. Ges.*, Bd. XVI, S. 629-692. pls. I—XIV.

LESTER F. WARD. Miocene Plants from Northern Bohemia—Ueber fossile Pflanzen aus tertiären Tuffen Nordbömens—Ueber die Flora der über den Braunkohlen befindlichen tertiärschichten von Dux; von H. Engelhardt.

Amer. Journ. Sci., XLIII, New Haven, April, 1892, pp. 336, 337.

Notice of above memoirs, the first in *Gen. Isis*, Abhandl. 3, Dresden, 1891, pp. 20–42, pl. I; the second in *Nova Acta d. Ksl. Leop-Carol. Deutsch. Akad. d. Naturf.*, Bd. LVII, No. 3, Halle, 1891, pp. 131-219, pls. I—XVII.

LESTER F. WARD. Calcareous Algae. Fossile Kalkalgen aus den Familien den Codiaceen und der Corallineen; von Herrn Rothpletz in München, 1891.

Amer. Journ. Sci., Vol. XLIII, New Haven, April, 1892, p. 337.

Notice of above memoir in *Zeitschr. d. Deutsch. geol. Ges.*, Bd. XLIII, Berlin, 1891, S. 295–322, pls. XV—XVII.

LESTER F. WARD. On the Fructification of *Bennettites Gibsonianus*, Carr.; by H. Graf zu Solms-Laubach, London, 1891.

Amer. Journ. Sci., XLIII, New Haven, April, 1892, p. 337.

Notice of above memoir in *Annals of Botany*, Vol. V, November, 1891, pp. 419–454, pl. XXV, XXVI. For fuller notice of the original German in *Bot. Zeitung*, see *Amer. Jour. Sci.*, for April, 1891; (Vol. XLI, p. 331).

LESTER F. WARD. Le Nelumbium Provinciale des Lignites de Fuveau en Provence par le Marquis G. de Saporta, Paris, 1890 L.

Amer. Journ. Sci., XLIII, New Haven, April, 1892, pp. 337, 338.

Notice of above memoir in *Mem. Soc. Geol. de France*, Tome I, Fasc. 3, Mem. No. 6, p. 9, pls. XII-XIV.

LESTER F. WARD. Reserches sur la Vegetation du niveau Aquitanien de Manosquepar le Marquis G. de Saporta, Paris, 1891.

Amer. Journ. Sci., XLIII, New Haven, April, 1892, p. 338.

Notice of above memoir in Mem. Soc. Geol. de France, Tom II, Nympheinees, Fasc. 1, Mem. No. 9, pp. 22, pl. III—VI; II, Palmiers, Fasc. 2, Mem. No. 9, pp. 23-34, pls. IX—XI.

LESTER F. WARD. Remarks on the law of corrasion.

Proc. of the Philosophical Soc. of Washington, October 27, 1888. Bulletin, Vol. XI, Washington, April, 1892, pp. 519, 520.

Abstract of remarks upon a paper read by Maj. J. W. Powell on the laws of corrasion, describing the manner in which the Missouri River erodes its banks.

J. ELFRETH WATKINS. The Infancy of the Mechanic Arts.

Read before the Engineering Section of the American Association for the Advancement of Science, at Washington City, August, 1891, an abstract appearing in the *Proc. Amer. Asso. for the Advancement of Sci.*, 1891.

J. ELFRETH WATKINS. Importance of Preserving Historical Relics.

Read before the joint meeting of the Old-Time Telegrapher's Association and the Military Telegrapher's Association, of Washington City, August, 1891, and published in the *Proceedings of the Old Time Telegrapher's Association and Military Telegrapher's Association*, 1891.

J. ELFRETH WATKINS. The Camden and Amboy Railroad Origin and Early History.

An address delivered at Bordentown, N. J., Nov. 12, 1891, upon the completion of the monument erected by the Pennsylvania Railroad Company, to mark the first piece of track laid between New York and Philadelphia; and to commemorate the sixteenth anniversary of the first movement by steam upon a railway in the State of New Jersey, November 12, 1831.

Bordentown Monument Memorial Volume, issued by the Pennsylvania Railroad Company, and *The Railway Review*, Chicago, November and December, 1891.

J. ELFRETH WATKINS. (Editor.) Numerous Editorials and Contributions upon Topics relating to Invention.

Published in the *Inventive Age*.

J. ELFRETH WATKINS. (Editor.) Celebration of the Beginning of the Second Century of the American Patent System, at Washington City, D. C., April 8, 9, 10, 1891.

Published by the Executive Committee, Patent Centennial Celebration, Washington City, 1892.

J. ELFRETH WATKINS. The Development of the American Rail and Track, as illustrated by the collection in the U. S. National Museum.

Reprinted, 1892, from the *Report of the Smithsonian Institution* (U. S. National Museum), 1889 (1891). Also reprinted in *Engineering*, London, beginning with June 10, 1892.

J. ELFRETH WATKINS. Ramsden Dividing Engine.

Reprinted from the *Report of the Smithsonian Institution* for the year 1891.

J. ELFRETH WATKINS. Log of the Savannah.

Report of the Smithsonian Institution (U. S. National Museum), 1890 (1891), pp. 611-639.

J. ELFRETH WATKINS. Report on the Section of Transportation and Engineering in the U. S. National Museum, 1889.

Report of the Smithsonian Institution (U. S. National Museum) 1889 (1891), pp. 293-299.

HARRIS H. WILDER. Die Nasengegend von *Menopoma alleghaniense* und *Amphiuma tridactylum* nebst Bemerkungen über die Morphologie des *Ramus ophthalmicus profundus trigemini*.

Zool Jahrb., Abth. Anat., v, ii, May, 1892, pp. 155-176+pls. XII, XIII.

GEORGE H. WILLIAMS. The Nonfeldspathic Intrusive Rocks of Maryland, and the course of their alteration.

American Geologist, VI, July, 1890, No. 1.

A description of some interesting pyroxénic eruptives collected by Mr. George P. Merrill, near Webster, N. C.

THOMAS WILSON. (Anthropological notes in the *American Naturalist.*)

Proceedings of the International Congress of Anthropology and Prehistoric Archæology, XXV, No. 295, July, 1891, pp. 675-679; No. 296, August, 1891, pp. 764-768; No. 297, September, 1891, pp. 840-844; No. 299, November, 1891, pp. 1031-1034.

Proceedings of Section H (Anthropology) at the American Association for Advancement of Science, held in Washington, D. C., August 17-25, 1891; No. 298, October, 1891, pp. 929-935; No. 299, November, 1891, pp. 1037-1039.

Prehistoric Man of Spy; No. 299, November, 1891, pp. 1034-1037.

THOMAS WILSON. La Période Paléolithique dans l'Amérique du Nord. IX. Congrés Internationalé des Américanistes. Paris, 1890. *Ernest Leroux*, éditeur, Paris, 1892, 32 pp., 8vo.

THOMAS WILSON. Report on the Department of Prehistoric Anthropology in the U. S. National Museum, 1889.

Report of the Smithsonian Institution (U. S. National Museum), 1889 (1891), pp. 317-339, pls. V-XI.

WILLIAM S. YEATES and EDWARD F. AYRES. Plattnerite and its occurrence near Mullan, Idaho.

Amer. Journ. Sci., XLIII, May, 1892, p. 407.

A résumé of published papers on plattnerite; a description of its occurrence in Idaho; its physical characteristics and blowpipe reactions; an analysis; a discussion of its specific gravity, with a determination placing it at 8.56, and a discussion of its crystallographic form assigning the mineral to the tetragonal system, are here given.

SECTION V.

LIST OF ACCESSIONS TO THE U. S. NATIONAL MUSEUM DURING THE YEAR ENDING JUNE 30, 1892.

LIST OF ACCESSIONS.

Abbott, W. H. (U. S. Fish Commission). Twenty-seven specimens of *Corydalus cornutus* and one of *Orthosoma brunneum*. 24672.

Abbott, Dr. W. L. (Bombay, India). A very interesting and valuable collection, consisting of 362 birds' skins, sternum of hawk, *Haliæetus leucoryphus*, a rope made of goat's hair and used by the coolies in Kashmir, in packing their loads, mammal skins and skulls obtained in Kashmir and Baltistan, including specimens of the Himalayan ibex and Vigne's sheep. 25470.

Abel, J. C. (Lancaster, Pa.). Ninety-three stone objects found along the Conestoga streams near Lancaster (24992); 64 arrow-points, fragments of pottery, and other objects found near Little Washington (25197); 187 archæological objects, consisting of rude implements, chips, flakes, broken arrow and spear-heads, scrapers of quartz, quartzite, jasper, and chert, also fragments of pottery from the Conestoga Hills (25255); 44 stone implements from near Lancaster (25314); 190 small rude implements, arrow and spear-heads, and other objects from Little Washington and Lancaster (25349); 18 rude chipped implements, hammer-stone, arrow-head and similar archæological objects from near Wheatland (25466); 80 rude implements, arrow-heads of white quartz, small rude implements of argillite, hammer-stones, stone used for polishing or grinding, rude chipped implement, chips and flakes of quartz, and pebbles (25722); 137 rude implements, worked flakes, arrow-heads and flakes of quartzite, arrow-heads, worked flakes, and other objects of flint, jasper and felsite, arrow-heads of clay, slate, and argillite from the Conestoga Hills (25740); *83 archæological objects from the same locality (25796).

Abert, Dr. Charles (Rockville, Md.). Black-billed cuckoo (*Coccyzus erythropthalmus* (24659); black-throated blue warbler (*Dendroica cærulescens*), in the flesh (25657).

Adams, A. A. (Warren, Ohio). Spider (*Epeira insularis* Hentz). 24970.

Adams, Mrs. Sarah M. (Momence, Ill.). Silk-moth (*Telea polyphemus*). 25805.

Adler, Dr. Cyrus (U. S. National Museum). Collection of arms, instruments, manuscripts, and parts of costumes from Egypt (gift) (24683); Soudanese girdle worn by women, and a camel driver's coat from the Upper Nile region (deposit) (25565); Hebrew charm, manuscript on parchment (gift) (25878). (See under Dr. John P. Peters.)

Agassiz, Prof. Alexander. (See under Fish Commission, U. S.).

Agee, N. A. (Perdue Hill, Ala.). Specimens of yellow ocher. 25208.

Agriculture, Department of. A very interesting collection of land and fresh-water shells from various localities in Arizona, vicinity of Death Valley and adjacent region (24542); land and fresh-water shells from Brownsville, Tex., collected by William Lloyd (24636); 3 gray seals from Labrador (25139).

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*This collection not entered in Museum register until August 4, 1892. The record will appear in the Report for 1892-'93.

Agriculture, Department of—Continued.

Division of Forestry. 45 photographs (24531); 18 photo-micrographs of woods of the United States (24532); 12 distribution charts of trees of the United States, prepared by Mr. C. S. Sargent, special agent of the Tenth Census (24533). Deposit.

Division of Ornithology and Mammalogy (through Dr. C. Hart Merriam). Three hundred and twenty-three birds' eggs and 55 birds' nests from California, Nevada, Utah, and Texas (25006); 3 portions of *Elephas* bones (25268).

Division of Entomology (through Prof. C. V. Riley). One hundred and seventy specimens representing 11 species of rare coleoptera, new to the collection, obtained in San Diego and Los Angeles counties, Cal., by Mr. D. W. Coquillet (24628); type specimens representing 5 new species of bombylidæ, consisting of *Lordotus junceus* Coq., *Lordotus diversus* Coq., *Toxophora vasta* Coq., *Paracosmus insolens* Coq., *Amphicosmus elegans* Coq., 8 species of rare coleoptera, 7 species of rare orthoptera, collected by Mr. Coquillet (24816); 3,473 specimens representing 636 species of insects from the Death Valley Expedition, March and April of 1889, collected by A. Koebele (24889); large series of hymenoptera and homoptera, collected by Mr. Coquillet in southern California (24890); collection of miscellaneous insects, including biologic material, collected by Mr. F. G. Schaupp, Cypress Mill, Tex. (24897); 24 species of North American coleoptera, new to the collection (24940); 8 species of Australian hemiptera, collected by Mr. J. G. O. Tepper, of Adelaide, South Australia (24941); 78 specimens representing 25 species of insects, mostly lepidoptera, collected by Mr. Coquillet in California (24950); 55 specimens of Californian orthoptera, representing 21 species, some of which are new to the collection, obtained by Mr. Coquillet (25005); about 200 specimens of various orders of insects, collected by Mr. C. G. Schaupp in Burnet County, Tex. (25110); 236 specimens representing 35 species of North American coleoptera, and 35 specimens, representing 4 species of New Zealand *Coccinellidæ*, collected by Mr. Coquillet (25111); 28 specimens representing 4 species of Australian *Coccinellidæ*, 245 specimens representing 51 species of Californian coleoptera, 81 specimens representing 31 species of Californian lepidoptera, 200 specimens representing 59 species of Californian hymenoptera, 246 specimens representing 64 species of Californian hemiptera, and 182 specimens representing 18 species of Californian diptera (bombylidæ), including types of new species, collected by Mr. Coquillet (25356); 43 specimens representing 17 species of neuroptera, 31 specimens representing 7 species of orthoptera, and 130 specimens representing 43 species of hemiptera, collected by Mr. Coquillet in Los Angeles (25400); collection of insects of all orders, made in the northwestern states, British Columbia, and Alaska (25554).

Division of Botany (through Dr. George Vasey). Specimen of the "travelers tree" of Mexico. 25287.

Ainley, John H. (Rapid City, S. Dak.). Specimen of hornblendic schist showing free gold from the Cross Mine, Pennington County. 25396.

Alaska Commercial Company (San Francisco, Cal.). (See under B. C. Winston.)

Aldrich, J. M. (Brookings, S. Dak.), through Prof. C. V. Riley. Twenty specimens representing 6 species of North American hymenoptera. 25358.

Alexander, John (Nicosari, Sonora, Mexico). Silver ore. 25189.

Albert, Philip (Shawnee, Pa), through Dr. R. E. C. Stearns. A stone pestle from Monroe County. 24677.

Allen, C. M. (Butte, Mont.), through Messrs. Packard and Melville of the U. S. Geological Survey. Copper matte. 24796.

Allen, George A. (U. S. Indian agent, Colorado River Agency, Parker, Ariz.). Specimens of *Pepsis formosa* Say. and *Sphærophthalma creusa* Cress.; skins of two rare bats, *Macrotus californicus* and *Molossus californicus* (25046); specimens of *Trombidium*, n. sp., near *giganteum* Riley (25402).

Allen, Ira R. (Fair Haven, Vt.). Two cut specimens of spessartite from Amelia, Va. 25739.

Allen, Rev. Jonathan (president of Albert University, Alfred Centre, N. Y.). Fourteen specimens of natural formation from New Jersey, resembling stone objects. 25056.

American Museum of Natural History (New York City, N. Y.). Ninety-one specimens, representing 31 species of birds' skins, from Chapada, Matto Grosso, Brazil. Exchange. 25222.

Ames, Dr. Howard E. (U. S. Navy). Two scorpions from Peru; skin of penguin from the coast of Chile; specimens of reptiles, crustaceans, and ophiurans from the west coast of South America; and 25 species of fishes from the West Indies and South America. 24892.

Ami, Henry M. (Geological Survey Department, Ottawa, Canada). Eight specimens of black-nosed dace (*Rhinichthys nasutus* and *Rhinichthys atronasus*). 25440.

(See under Geological Survey of Canada).

Ancey, C. F. (Boghari, Algeria). Ten species of rare African shells (25320); 12 species of land and fresh-water shells from Africa (25465); 27 species of African shells (25556). Exchange.

Anderson, J. V. (Little Creek, Del.). American barn owl (*Strix pratincola*). 25704.

Andrews, A. H., & Company (Chicago, Ill.). Goff's historical chart of North America, No. 1. 25348.

Andrus, W. J. (Hackensack, N. J.). Two specimens of buff Pekin bantams. 25635.

Angell, G. W. J. (New York City). One hundred and eight specimens, representing about 50 species of exotic coleoptera (24667); specimen of *Zophobas morio*, and specimen of *Strophosomus coryli*, from Florida and New Jersey. (24675). Exchange.

Anthony, E. &. H. T., & Company (New York City). One pound each of Madgeburg, Nelson's Amber, and Nelson's Special Opaque Gelatine. 25577.

Armistead, L. C. (Hendersonville, Tenn.). Miniature head of clay resembling an idol, from Sumner County. 25188.

Armitage, John H. (Jamestown, N. Y.). Specimen of chrysotile from Canada. 25643.

Armstrong, Edward (Pittsburg, Pa.). Specimens of giant water-bug (*Benacus griseus*). 25798.

Armstrong, F. B. (Brownsville, Tex.). Four skins of Texan screech owl (*Megascops asio maccallii*) (24544); 4 eggs (one set) of white-tailed kite (*Elanus leucurus*) (25761). Purchase.

Arnheim, Julius S. (San Francisco, Cal.). Land and marine shells from Alaska and California. (24539, 25847).

Arrington, W. A. (Arrington, Va.). Specimens of massive apatite, apatite and menaccanite, and kaolin, collected by Mr. W. S. Yeates, U. S. National Museum. 24714.

Atkinson, Edward (Boston, Mass.), through Prof. W. O. Atwater. Specimens of rice, millet, and other food products used in China. 25765.

Attwater, Prof. H. P. (Rockport, Tex.). Eggs of *Chondestes grammacus strigatus*, *Mimus polyglottus* and *Vireo noveboracensis*, and eggs of *Cardinalis cardinalis* and *Mimus polyglottus*, a very interesting series selected to show extremes in size and coloration (25441); eggs of *Otocoris alpestris giraudi* and 2 nests (new to the collection) (25669); eggs of Texan horned owl (*Otocoris alpestris giraudi*) (25782).

Atwater, Prof. W. O. (See under Edward Atkinson.)

Auckland Museum (Auckland, New Zealand), through Prof. T. F. Cheeseman, curator. Skeletons of 7 birds, *Megalestris antarcticus*, *Ocydromus greyi*, *Ocydromus earli*,

Auckland Museum—Continued.
Casarca variegata, *Hymenolæmus malacorhynchus*, and *Apteryx australis*; 450 botanical specimens, insects, and birds' skins. Exchange. 24957.

Australian Museum (Sydney, New South Wales) through Dr. E. P. Ramsay, curator. Graptolites, echinoderms, collection of birds' skins, and a collection of mammals containing skins of a considerable number of species of marsupials not previously represented in the Museum (24597); 132 specimens representing 50 species of crustaceans, and 51 specimens representing 13 species of Asteroidea (25661). Exchange.

Avery, S. P. (New York City). Dry-point "Moonlight" by Aug. DelÂrte. 25795.

Avery, Dr. William C. (Greensboro, Ala.). Five skins of purple grackle (*Quiscalus quiscula*). 25701.

Babcock, A. L. (Sherborn, Mass.). Fourteen species of European and 3 of South African coleoptera. Exchange. 25248.

Bacon, Mrs. Oliver T. Photograph of a fragment of red limestone found on the roadway leading to the cross on the summit of Rofelspize, a mountain near the village of Oberammergau. 25646.

Bailey, H. B. (Newport News, Va.). Specimens of *Strophosomus coryli*, *Polyphylla occidentalis*, and *Tetracha virginica*. Exchange. 24893.

Baker, A. B. (See under Smithsonian Institution. National Zoölogical Park.)

Baker, Dr. Frank. (See under Smithsonian Institution. National Zoölogical Park).

Balfour, Henry (University Museum, Oxford, England.) Flint core, 4 paleolithic implements, scraper, and a small polished hatchet from France; 2 flint scrapers from England, and 3 stone hatchets (Carib) from the West Indies. Exchange. 24708.

Barber, F. A. (Washington, D. C.). English mastiff, in the flesh. 24563.

Barnes, E. A. (Syracuse, N. Y.). Dandelion with ten flowers on one stalk. 25813.

Bartholomew & Co. (New Orleans, La.). Specimens of black grunt (*Hæmulon plumieri*), gulf toadfish (*Batrachus taupardus*), and moray (*Sidera* [*Muræna*] *moringa*). 25405.

Bartleman, R. M. (United States legation, Carácas, Venezuela). Photograph of the shores of the lagoon of Sinamaica, Goagira lake-dwellings, from the same locality, and group of Goagira Indians (24880); 19 photographs of native scenery and other objects of interest relating to Venezuela (25072). (See under Smithsonian Institution, National Zoölogical Park.)

Barton, George H. (Boston Society of Natural History, Boston, Mass.). Specimens of melaphyr from Brighton. Exchange. 25105.

Bates, Kimball & Guild (Boston, Mass.). Set of six reproductions of pencil sketches by Woodbury. 25539.

Baur, Dr. G. (Worcester, Mass.). Turtle. 25817.

Bayley, Prof. W. S. (Waterville, Me.). Rocks and ores from Maine and New Hampshire. Exchange. 25366.

Beal, Kenneth F. (Washington, D. C.). Specimens of *Cambarus diogenes* and *Cambarus bartonii* (25723); 2 specimens of *Tropodonotus leberis* and *Tropodonotus sipedon* (25773); mud-turtle (*Kinosternon pennsylvanicum*) from Virginia (25814).

Beale, Hon. Truxton (Washington, D. C.). Three moldings of sculptures from Persepolis, Persia. 25881.

Bean, Barton A. (See under Thomas C. Fagan.)

Bean, Dr. T. H. (U. S. Fish Commission). Turtle from Havre de Grace, Md. (25446); skin of red phalarope (*Crymophilus fulicarius*) (25495).

Beauregard, Dr. E. (See under Museum of Natural History, Paris, France.)

Beck, Rollo H. (Berryessa, Cal.). Skin of Herman's song sparrow (*Melospiza fasciata heermanni*); skin of Bryant's marsh sparrow (*Ammodramus sandwichensis bryanti*) from California, new to the collection (25635); 98 specimens, representing 58 species of birds' skins (25477).

Becker, Dr. G. F. (See under Interior Department. U. S. Geological Survey.)

Beckers, Alexander (Hoboken, N. J.). Collection of daguerreotypes, ambrotypes, and coleotypes, collected by Miss F. B. Johnston. 25295.

Beckwith, Paul (Washington, D. C.). Photographs taken from a pencil sketch, made by Col. Réni Paul, of the first residence built in the city of St. Louis, Mo., in 1764 (gift) (24724); Jubilee medal, Pope Leo XIII, issued on the fiftieth anniversary of his episcopacy (exchange) (24834).

Bednall, W. T. (South Australian Museum, Adelaide, South Australia). Specimen of saturnid-moth (*Antheræa eucalypti*). 25616.

Belden, Hon. J. J. (See under B. T. Nash.)

Belding, L. (Stockton, Cal.). Seventeen specimens, representing 11 species of birds' skins from California (24846); head, wing, and foot of a blue goose (*Chen cærulescens*) from Stockton (25438); charm-stone from Gridley, Cal., and four pieces of burnt clay, ornamented with lines and dots, from an Indian burying-ground near Stockton (25641); 6 birds, representing 2 species from California (25660).

Bement, C. S. (Philadelphia, Pa.). Five specimens of minerals from various localities, consisting of satin spar, amazonstone, lepidolite, churchite, and jade. 25395.

Bendire, Capt. **Charles** E., U. S. Army (U. S. National Museum). Eggs of *Tantalus loculator* from Yucatan (gift) (25017); skin of American pipit (*Anthus pensilvanicus*) from Lockport, N. Y. (gift) (25705); large buffalo robe, lance-holder (rawhide beaded), and quiver of otter skin (beaded), (deposit) (25827).

(See under B. L. Cunningham, Chase Littlejohn, L. M. Loomis, R. MacFarlane, W. L. Ralph, W. G. Smith, R. S. Williams.)

Benedict, Dr. A. L. (Buffalo, N. Y.). Three hundred and ten archæological objects, consisting of rude-chipped implements, pestles, hatchets, fragments of pottery, and other objects, principally from Indian villages. 25369.

Benedict, James E. (U. S. National Museum). Specimens of *Gelasimus minax* from Point Lookout, Md. 25074.

Benjamin, Park (New York City). Original application of Jesse Ramsden, dated December 2, 1775, for a patent in England, written and signed by himself, for an astronomical equatorial instrument. 25007.

Benjamin, Dr. **Marcus** (New York City). Complete collection of portraits and autograph letters of members of the National Academy of Science. Deposit. 25852.

Benson, Lieut. **Harry** C., U. S. Army (Fort Walla Walla, Wash.). Eggs of *Buteo swainsoni* and *Accipiter cooperi* from St. Louis Ranch, San Joaquin Valley, California; specimen of Swainson's hawk (*Buteo swainsoni*) from Santa Lucia Valley, California (25756); 3 skins of hummingbird (*Trochilus alexandri*), with nests and eggs (25790).

Beyer, G. (New York City). Collection of 1,900 specimens, representing 900 species of native and exotic lepidoptera. Exchange. 25378.

Bierstadt, E. (New York City). Seven proofs of a chromo-collograph from an oil painting, showing the progressive stages, made in the establishment of the donor. 24689.

Binney, W. G. (Burlington, N. J.). Specimen of *Helix strigosa* from the loess of Iowa (24596); photographs of teeth of mollusks, the original drawings of shells and slugs, and cuts of shells used in various publications on land-shells, constituting a valuable donation (25027).

Bird, John C. (St. Louis, Mo.), through J. W. Hulse. A flint-lock breech-loading musket with a silver plate inscribed "By resolve of Congress, presented to Gustavus A. Bird, for his gallantry at the seige of Plattsburgh," and a smaller plate with "G. A. B. Sept. 11, 1814." 25598.

Black, J. C. (See under J. C. Hart.)

Blackburn, Edwin (Denver, Colo.). Specimen of radiolites from the Niobrara limestone at Morrison, Colo., and lava probably polished by the rubbing of buffaloes, from Folsom, N. Mex. 25085.

BLAINE, Hon. JAMES G. (See under Department of State.)

BOARMAN, Dr. C. V. (Washington, D. C.). Specimen of rhinoceros-beetle (*Dynastes Tityus* L.), from Quantico, Va. 24578.

BOAS, Dr. FRANZ (Worcester, Mass.). Chinook cradle and a carved wooden figure. Purchase. 25433.

BOEHMER, GEORGE H. (Smithsonian Institution). Second-class ticket for transportation on Darjeeling Himalayan Railway from Siligura to Kurseong (gift) (25001); books containing engravings of imperial arms, works of art, and others (exchange) (25178); 4 black rats found in a box of books received from Brazil (25668).

BOOTH, Mrs. JAMES C. (Haverford, Pa.). Platinotype portrait of Prof. James C. Booth, PH. D., LL. D., late melter and refiner of the United States Mint at Philadelphia. 25785.

BOSWELL, HENRY (Washington, D. C.). Smooth-headed, yellow-winged turbit pigeon. 25220.

BOSWELL, J. H. (Upper Marlboro, Md.). One hundred and nineteen archæological objects, consisting of grooved axes, rude notched axe, arrow or spear-heads of quartzite, felsyte and honstone, white quartz, jasper, and black flint. Exchange. 24591.

BOUCARD, A. (London, W. C., England). Twelve specimens, representing 10 species of birds' skins, *Psittacidæ*. Purchase. 25048.

BOURKE, Capt. JOHN G., U. S. Army (Fort Ringgold, Tex.). Three votive offerings, consisting of "Milagros or Promesas," vows or promises, of silver; "Gallo," a figure of a cock used in games on the Lower Rio Grande; and "Pilon," a box in which record is made of purchases in order to give buyers a per cent off (gift) (24541); collection of Guadalajara pottery (gift) (24671); throwing-stick and bird-spear from Mexico (deposit) (24899); soles of the "Guarachi" or sandals used by the Mexican foot soldiers along the Rio Grande (deposit) (25103); 5 specimens of materia medica obtained from an old Mexican woman (gift) (25152); 16 specimens of folk-medicine of the Lower Rio Grande Valley (deposit) (25282); salt crystals from the lake known as "El Sal del Rey" in southern Texas (gift) (25619).

BOWDITCH, F. C. (Brookline, Mass.). Thirty-six specimens of North American coleoptera, new to the collection. Exchange. 25593.

BOWEN, Dr. CLARENCE W. (New York City). Programmes, circulars, invitation cards, and other official papers relating to the centennial celebration of Washington's Inauguration, in New York City, April, 1889. 24551.

BOWERS, Hon. W. W. (House of Representatives). Block of pure pig-iron, and specimen of tin ore from the Temescal tin mine, South Riverside, San Bernardino County, California. 25183.

BOWMAN, D. A. (Bakersville, N. C.), through Prof. F. W. Clarke. Arrow-head of obsidian, and one of flint from a mine in Salt River Valley, near Arizona (24549); 2 specimens of tscheffkinite from Mitchell County, collected by Mr. W. S. Yeates, (24790); specimens of minerals (24713); Indian arrow-head from Woodey Hill, near Bakersville (24997); specimen of tscheffkinite (25285).

BOYLE, C. B. (See under Interior Department. U. S. Geological Survey.)

BOYLE, Mrs. MARY (Flemington, N. J.). Non-pearly concretion found in a round-clam, *Venus mercenaria*. 25065.

BOYNE, R. (Washington, D. C.). Young alligator from Florida. 25454.

BRACE, Mrs. CHARLES L. (Ches-knoll, Westchester County, N. Y.), through Miss Emma Brace. Silver medal which was presented in 1877 by Victor Emanuel to the late Charles L. Brace, for his labors among the Italian children in New York. Deposit. 25476.

BRACE, Miss EMMA. (See under Mrs. Charles L. Brace.)

ADNER, Dr. W. B. (Warwick, N. Y.). Specimen of *Dynastes hercules*, 2 specimens f *Dynastes tityus*, and a few other beetles. 25023.

Brady, Prof. George S. (Sunderland, England). Specimens of British fresh-water cyclopidæ. Exchange. 25283.

Bragg, L. C. (San Diego, Cal.). Twenty-one specimens of *Branchiostoma lanceolatum* (24728); type specimen of *Chilomycterus californiensis* (25173). Purchase.

Brennan, Daniel O. (See under Regular Army and Navy Union of the U. S. A.)

Brett, Walter (Lakeport, Cal.). Two skins of double-brested cormorant (*Phalacrocorax dilophus*) from California. 24743.

Bretz, George M. (Pottsville, Pa.). Portable dark tent, obtained by Miss F. B. Johnston. 25304.

Brimley, H. H. & C. S. (Raleigh, N. C.). Four specimens, representing 3 species of birds' skins (purchase) (24818); skins of various species of small North American mammals (purchase) (25181); 6 specimens of wood-rats, *Neotoma floridiana* (purchase), (25221); 2 nests of *Dendroica dominica* (gift), (25408); mounted catbird (*Galeoscoptes carolinensis* (purchase), (25703).

British Museum (London, England). Four Australian throwing-sticks (25151); through Dr. Henry Woodward, 4 teeth of mammoth, *Elephas primigenius* (25330). Exchange.

Britton, L. H. (New Lisbon, Ohio). Egg of snake. 24860.

Britton, Dr. N. L. (Moravia, Pa.), through Mr. Thomas Wilson. Two perforated stone tablets. 25313.

Brock, Herbert E. (Mason City, Iowa). Fossils (24561); eleven specimens of crinoids (25508); 5 carboniferous fossils, 9 devonian, 4 silurian, and 1 cretaceous (25683). Exchange.

Brown, A. H. (U. S. National Museum). Seven photographs of natives of the west coast of Africa. Purchase. 24746. (See under Smithsonian Institution. U. S. National Museum.)

Brown, C. F. (Hot Springs, Ark.). Specimen of rectorite (gift), (24707); 6 specimens of descloizite from Mammoth Mine, Pinal County, Ariz., and 1 specimen of rectorite, from Garland County, Ark. (exchange), (25750).

Brown, Herbert (Tucson, Ariz.). Two garter snakes (Eutainia megalops) (24629); 2 alcoholic specimens of snakes, and 4 alcoholic specimens of beetle, *Allorhina mutabilis* Gory, and cockroach, *Phyllodromia* sp. (24799); snake, *Salvador grahamiæ* (24856); 2 garter-snakes (*Eutainia*) (24962); 2 snakes, *Rhinocheilus* (25487).

Brown, R. W. (Washington, D. C.). Specimen of *Helix alanda* found in a bunch of bananas (24534); *Helix aspersa* Fer., found alive in a bunch of bananas, probably from Jamaica (24538); *Helix aspersa* (24598); 3 specimens of *Helix alanda* Fer., from the West Indies (24637); spider, belonging to the family *Theraphosidæ*, from Central America (24657; spider, *Dolomedes scriptus* Hentz (24767); spider (24963); two snakes, *Storeria dekayi*, collected by Mr. James Davis (25021); crab *Sesarma* (25075); *Helix americana* (25478); spider, *Heteropoda vinatoria* L., from Curaçoa (25519); tropical spider, belonging to the family *Theraphosidæ* (25793).

Brown, Sevellon A. (See under State, Department of.)

Rrown, W. H. and A. H. (See under Smithsonian Institution. U. S. National Museum).

Bruner, Prof. L. (Lincoln, Nebr.), through Prof. C. V. Riley. Thirty-eight specimens, representing nine species of North American coleoptera, and 4 types of a new orthoptera, *Myrmecophila nebrascensis* Bruner. 24976.

Bryan, George R. (See under O. N. Bryan.)

Bryan, O. N. (Marshall Hall, Md.), through George R. Bryan. One hundred and forty specimens of fossil bones, birds' skins, collection of archæological objects, shells, specimens of Devonian and Trenton Group fossils, fossil plants, ores and rocks. 24837. (Bequest.)

Bryant, C. M. (Washington, D. C.). Living specimen of horned toad. 25429.

Bryant, Henry G. (Philadelphia, Pa.) Collection from Labrador and Newfoundland, consisting of skulls of black bear (*Ursus americanus*), lynx (*Lynx canaden-*

BRYANT, HENRY G.—Continued.
sis), porcupine (*Erethizon dorsatus*), otter (*Lutra canadensis*), and varying hare (*Lepus americanus*); ethnological objects; specimens of moss; human and animal bones from a battle-field on Eskimo Island; trilobite (*Paradoxides bennetti*); geological material. 25288.

BULLMAN, CHARLES. (See under Haskins Wood Vulcanizing Company.)

BURCH, WILLARD. (See under William Palmer.)

BURDINE, W. T. (Washington, D. C.). Specimen of whippoorwill (*Antrostomus vociferus*), in the flesh. 25730.

BURGER, PETER (U. S. National Museum). Pair of lamp-trimming shears (24923); old-fashioned sand box used for drying ink (25107).

BURNS, FRANK (Smithsonian Institution). Grooved axe and discoidal stone from Laurens County, South Carolina (24647); 4 specimens of lignite from Hoenes Mine, Ababama (25359); iron tomahawk from Blunt County, Alabama (25363). (See under Interior Department. U. S. Geological Survey.)

BURNS, W. R. (Concord, Ky.). Six small arrow or spear-heads (24592); 4 archæological objects (25415).

BURT, M. W., JR. (Ironwood, Mich.). Alcoholic specimen of *Epeira trifolium*. 25406.

CALCUTTA BOTANIC GARDEN (Calcutta, India), through Department of State. A fine collection of dried plants. 25563.

CALLENDER, W. N. (Greenbush, N. Y.). Stone port-hole from the Van Rensselaer mansion built at Greenbush, opposite Albany, N. Y., in 1642. Purchase. 25051.

CALLENDER, MRS. W. N. (Greenbush, N. Y.). Hand-made shingle from the original portion of the Van Rensselaer mansion, built at Greenbush in 1642. 24967.

CALVERT, PHILIP P. (Philadelphia, Pa.). Three dragonflies, representing the species *Lepthemis gravida* Clav., and *Lepthemis proxima* Hagen. 25609.

CAMP, J. H. (Leopoldville, Congo, Central Africa). Collection of African butterflies (25504); 4 photographs of natives of West Africa (25661). (See under Department of State.)

CAPWELL, V. L. (Luzerne, Pa.). Sandstone concretion from Forty-Fort, Luzerne County. 25179.

CARLYLE, A. C. (London, England), through Mr. Charles Seidler. 1674 stone relics from India. Purchase. 25122.

CARMICK, Master LOUIS (Brookland, D. C.), through Mr. Robert Ridgway. Red-shouldered hawk (*Buteo lineatus*). 24847.

CARTER, JAMES C. (New York City). Specimen of hybrid between mallard and pintail duck (*Anas boschas* + *Dafila acuta*) from Swan Island, Currituck Sound, North Carolina (25265); specimen of wigeon (*Mareca penelope*) from the same locality (25310); and 2 specimens of American merganser (*Merganser americanus*) from Carroll's Island, Chesapeake Bay (25437).

CASSELL, Capt. W. H. (Baltimore, Md.). Four specimens of Virginia deer (*Cariacus virginianus*), collected by Mr. William Palmer of the National Museum. 24954.

CATON, H. J. (Rosebud Agency, S. Dak.). Fossil turtle, *Stylemys nebrascensis* from Bad Lands (25411); impure opal from the same locality (25572).

CHAMBERS, J. A. (Tangier, Va.). Vegetable. 25035.

CHANLER, WILLIAM ASTOR (New York City). Two mounted giraffe heads, male and female, from East Africa. 24907.

CHANDLER, Prof. CHARLES F. (School of Mines, Columbia College, New York City). Waxed paper negative, silver-print from waxed paper negative, and blue-print from waxed paper negative, obtained by Mr. S. R. Koehler of the National Museum. 25533.

CHANUTE, O. (Chicago, Ill.). Collection of antique patterns of rail-sections, maps, and other objects. 25399.

CHAPIN, E. H. (Baltimore, Md.). Trilobite, *Phacops rana*, from the Hamilton Group, New York. 24610.

CHARLTON, T. (Denver, Colo.). Three teeth of extinct llama (*Auchenia hesterna*). 25054.

CHATARD, Dr. T. M. (U. S. Geological Survey). Scarfpin made of cassiterite from Chesterfield County, South Carolina. Deposit. 24552. (See under Interior Department. U. S. Geological Survey.)

CHEESEMAN, Prof. T. F. (See under Auckland Museum.)

CHERRIE, GEORGE K. (See under National Museum of Costa Rica.)

CHESHIRE, W. W. (U. S. Pension Office). Photograph of the breast-bone of a wild goose perforated by an Eskimo arrow. 24835.

CHIDSEY, CHARLES E. (Scranton, Miss.). Bone eaten by red ants, and petrified charcoal found on the banks of the Pascagoula river. 24824.

CHING, JOHN (Kilgore, Idaho). Elk skin. Purchase. 25297.

CHITTENDEN, Dr. JOHN F. (Victoria Institute, Trinidad, West Indies), through William P. Pierce, U. S. Consul, and Department of State. Two soles (*Achirus lineatus* and *Azevia* n. sp.). 25537.

CHURCH, F. L. (Shushan, N. Y.). Alcoholic specimen of six-legged frog. Purchase. 24770.

CLAIBORNE, J. H. (Well Springs, Tenn.). Manganese ore. 24605.

CLARK, JAMES J. (Troy, N. Y.), through J. M. Francis and Hon. Owen Riley. Small box made from a limb of the tree in Scotland, under which Sir William Wallace concealed himself. This box was sent to Mr. Clark in 1818 by a weaver of Paisley. 24883.

CLARK, Miss MAY (U. S. Geological Survey). Fetish (mole) from New Mexico. Exchange. 24577.

CLARKE, Prof. F. W. (See under D. A. Bowman and Jacob Snyder.)

CLARKE, Prof. J. M. (See under New York State Museum.)

CLAY, Col. CECIL (Department of Justice). Five specimens of woodland caribou from Newfoundland. Purchase. 25140.

CLAYWELL, ROBERT T. (Morganton, N. C.). Specimen of beryl with muscovite and tourmaline in quartz from Bourke County, and a specimen of transparent almandite from Laurel Garnet mine, near Morganton, collected by Mr. W. S. Yeates, of the U. S. National Museum. 24952.

CLORE, A. J. (Dulinsville, Va.). Specimen of wheel-bug (*Prionides cristatus*) (24908); parasitic wasp (*Ephialtes irritator* Fab.). (25014).

CLOUSE, HENRY (Phebe, Tenn.). Collection of ores from Union County. 25147.

COCKERELL, Prof. T. D. A. (Institute of Jamaica, Kingston, Jamaica), through Prof. C. V. Riley. Fourteen species of mollusks. 25838.

COFFIN, AMORY. (See under Phœnix Iron Works.)

COHEN, ROBERT. (See under F. J. Herell.)

COLBURN, Dr. G. F. (Washington, D. C.). Tooth of extinct shark, *Carcharodon megalodon*. 25613.

COLLETT, T. R. (Savannah, Ga.). Hawk-moth (*Enyo lugubris* L.). 24968.

COLLINS, Mrs. MARY C. (Fort Yates, N. Dak.). Twenty specimens, representing 7 species of cretaceous fossils from the Montana formation near Fort Yates. 25050.

CONKLIN, Mrs. E. (See under Smithsonian Institution. National Zoological Park).

CONNOR, Paul D. (Washington, D. C.), through Mr. George C. Maynard. Model of telegraph-pole, cross-arm and insulators, belonging to the "Old Time Telegraphers Collection." Loan. 25118.

COOKE, Dr. Clinton T. (Salem, Oregon). Two skins of Steller's jay (*Cyanocitta stelleri*) (parents of eggs purchased for oölogical collection) (24825); set of eggs of *Cyanocitta stelleri* (purchase) (24830); handsome nest of *Cyanocitta stelleri*, new to the collection (gift) (24981).

COOKE, Miss J. N. (San Diego, Cal.). Specimens of ostrea from the west coast of Lower California, collected by Captain George D. Porter. 25842.

Cooke, Prof. O. F. (Syracuse University, Syracuse, New York). *Oniscidæ* consisting of *Armadillidium vulgare, Oylisticus convexus, Oniscus murarius, Porcellio rathkei* from Syracuse, New York; *Metoponorthus pruinosus* from Provo, Utah; *Porcellio lævis, Porcellio scaber* from Colfax; *Porcellio rathkei* from Chaumont, New York; *Porcellio scaber* from Ocean Grove, New Jersey; *Porcellio scaber* from West Haven, Connecticut; *Porcellio scaber* from Bloomington, Illinois; *Porcellio spinacornis* from Goshen, Connecticut, and *Trichoniscus pusillus* from Niagara Falls, New York. Exchange. 24982.

Copeland, C. B. (See under Interior Department. U. S. Geological Survey.)

Coquillet, D. W. (See under Department of Agriculture.)

Cornell University (Ithaca, N. Y.), through Prof. B. G. Wilder. Alcoholic specimens of *Amblystoma* and *Necturus* from the Cayuga Lake Basin. Exchange. 25647.

Cory, C. B. (Boston, Mass.). Skin of crocodile-bird (*Pluvianus ægyptiacus*) from Egypt. Exchange. 25025.

Cossmann, M. (Paris, France). Specimens of tertiary fossils from the Paris Basin, France. Exchange. 25442.

Coulbourn, W. R. (Roanoke, Va.). Larva of rhinoceros-beetle (*Dynastes tityus*). 25123.

Courier Lithographing Company (Buffalo, N. Y.). Lithograph. 25876.

Cowan, R. L. (Harrisburg, Ark.). Specimens of tripoli (?) and rottenstone (?). 24798.

Cowie, Prof. James (Kanopolis, Kansas), through Prof. Robert Hay. Rock-salt. 25213.

Cox, Dr. J. C. (Sydney, New South Wales), through Charles Hedley, Australian Museum. Alcoholic specimens of *Ephippodonta Macdougalli* Tate, a very remarkable bivalve mollusk recently described from Australia. 25843.

Cox, Mrs. S. S. (Washington, D. C.). Memorial vase presented to Mrs. Cox by the members of the Life-Saving Service of the United States, in commemoration of the services of the late Hon. S. S. Cox. 25475.

Crawford, Hon. J. M. (Consul-General, St. Petersburg, Russia). (See under George F. Kunz.)

Cresson, Dr. H. T. (See under Mrs. B. D. Spenser.)

Crevecoeur, F. F. (Onaga, Kans.). Twenty-six species of insects. 25028.

Crissey, Dr. Sardis L. (Washington, D. C.). Red paint produced by burning nodules found in phosphate beds in Florida. 25078.

Crosby, F. W. (Washington, D. C.). Ores from California, Colorado, Mexico, New Mexico, Arizona, and Nevada (25272); collection consisting of 126 chalcedonic implements, chips, and fragments of pottery found on the north bank of Anclote River, Hillsborough County, Florida (25644). (See under Dr. H. W. Gould.)

Crosby, Prof. W. O. (Boston, Mass.). Nickle ore from Ontario and New Brunswick, Canada. Exchange. 25623.

Cross, Prof. Charles R. (Massachusetts Institute of Technology, Boston, Mass.). Heliotype printing film, with impression; 7 collographic specimens, and 2 woodburytype specimens. 25383.

Crosscup & West (Philadelphia, Pa.). Twenty-one specimens of work done by the new "Ives Process." 25486.

Culin, Stewart (Philadelphia, Pa.). Chinese game of Chong-un-ch'an (25539); 7 photographs illustrating religious objects (25809).

Cunningham, B. L. (Fort Klamath, Oregon), through Captain Charles E. Bendire. Three birds' skins. 25820.

Cunningham, C. W. (Santa Clara, Cuba), through Interior Department, United States Geological Survey. Sample of crude petroleum. 24580.

Dahl, F. O. (Libby, Mont.). Stone implement found near Libby Creek. Exchange. 25432.

Dall, William H. (U. S. Geological Survey). Ten specimens of mollusks from Baddeck, Cape Breton Island, Nova Scotia (gift) (24535); 6 volumes containing 331 photographs, representing ethnological objects and celebrated men, Hindoo "Kookry," 2 carrying-bands, and a sacred drum made of skulls (gift) (25241); daguerreotype of Rev. Charles H. A. Dall, of Harvard College (deposit) (25317); alcoholic and dry shells from Monterey, and fossils from Santa Barbara, California, cranium of sea-gull (*Sterna maxima*) from Monterey, sertularians from Port Harford and Monterey, and specimens of *Pollicepe* from the same locality (gift) (25846). (See under Mrs. Wyard.)

Daniel, Miss Irene (Fort Bennett, S. Dak.), through Prof. O. T. Mason and Dr. Z. O. Daniel. Teeth and ornaments obtained from the burial-place of a Sioux Indian. 24665.

Daniel, Dr. Z. T. (Cheyenne River Agency, Fort Bennett, S. Dak.). Specimen of hawk-moth (*Haemaris diffinis* Bd.) (24623); fragment of a quartzite leaf-shaped implement, 7 flint and chalcedony scrapers, 6 broken arrow and spear-heads from an ancient Indian village site near Fort Bennett, 20 chalcedonic concretions, and 10 fragments of water-worn chalcedony from the banks of Lake Robb (24653); scraper (?) from the ruins of a Ree village, at Cheyenne River Agency (24664); 3 scrapers and 2 fragments of arrow or spear-heads from an ancient Ree village (24731); 95 archæological objects, consisting of rude chipped implements, scrapers, arrow and spear-heads, fragments of a catlinite pipe, fragments of pottery and other articles from an ancient Indian village site near Fort Bennett, also 2 pieces of large leaf-shaped implement, and a pin-shaped object of stone from the same locality (24756); pipe made by "Afraid of Nothing," an Indian belonging to the Sioux tribe, and a pipe pouch made by an Indian of the same tribe (25083); moccasin-shaped stone (25134); 7 plum seeds "Kansu," used by the Sioux Indians for gambling purposes, and a ration ticket of "Banged-in-the-Eye" (25273); lock of hair cut from the head of "Yellow Thigh and Red Star," a Yankton Sioux Indian, and a participant in the Custer battle (25372); cut pin, whetstone, fragments of leather, bead-work, and other articles found in the débris of a camp of "Big Foot's" people (25449); wooden soup-spoon belonging to the Piegan Indians (25559); moccasin-shaped stone of natural formation found by a Blackfeet Indian on Two Medicinal Creek (25834). (See under Miss Irene S. Daniel.)

Dart, Dr. Richard (Brackettsville, Tex.). Snake skin from near the Las Moras River. 24906.

Davidson, A. (Los Angeles, Cal.). Specimens of diptera parasite on spiders' eggs, belonging to the family Oscinidæ (*Hippelates* n. sp. ?). 25246.

Davis, Britton (Carralitos, Chihuahua, Mexico). Specimen of the rare *Heterodon kennerlyi*. 24878.

Davis, James. (See under R. W. Brown.)

Davies, M. W. (Newport, Oregon). Specimen of spider, *Epeira insularis* Hentz. 24972.

Delaney, James M. (Rochester, N. Y.). Series of spines of 7 species of echinoderms, and a series of specimens representing about 12 species of *Hydromedusæ*. 24749.

Demcker, Robert (New York City). Twenty-one minerals from Hoboken, N. J. (24859); minerals (25758). Exchange.

De Saussure, Prof. H. (Museum of Natural History, Geneva, Switzerland). Sixty species of named orthoptera. 25271.

De Struve, Mr. Charles (Russian Legation, Washington, D. C.). Thirty-nine sheets of ethnological portraits of the inhabitants of Russia. 25447.

Denton, Sherman F. (U. S. Fish Commission). Specimen of bat, *Adelonycteris fuscus*, in flesh (24557); skin of white-bellied sea eagle (*Haliaetus leucogaster*) or allied species from Queensland, Australia (25352).

Depue, Robert (Middagh's, Pa.), through Dr. D. H. Hazen. Stone implement picked up in a plow-furrow on the banks of the Delaware River. 24945.

Dickinson, Thomas A. (See under Worcester Society of Antiquity.)

Dietz, Ottomar (New York City). Seventeen species of North American coleoptera. 25491.

Diller, Prof. J. S. (See under Interior Department. U. S. Geological Survey.)

Dodge, Mrs. Charles, jr. (San Carlos, Arizona). Large basket made by Chilchuana, an Apache Indian chief, the largest basket ever made by the Apache tribe. Purchase. 25088.

Dodge, Col. Richard I., U. S. Army (Sackett's Harbor, New York). Four specimens representing 2 species of horse-fly (*Gathophilus equi* Fab.), and a wasp, *Pelecinus polycerator*. 24845.

Dole Brothers (Boston, Mass.). Four-inch cube of granite from A. F. Eells' quarry at Bucks Harbor, Maine. 25430.

Donaldson, Thomas (Philadelphia, Pa.). Seven polished specimens and a cut stone of turquoise from Los Cerillos, New Mexico. Deposit. 24602.

Dorsey, Mrs. W. P. (Silver City, N. Mex.). Three arrow or spear-heads. 24815.

Drake, C. F. (Weiser, Idaho). Ore from the Copper Key Mine, Seven Devils Mining District, Washington County. 25081.

Dufour, Dr. (Riverdale, Md.). Sharp-shinned hawk (*Accipiter velox*). 25168.

Dufour, Dr. J. R. (Washington, D. C.). Skin of brown pelican (*Pelecanus fuscus*) from Navassa, West Indies. 25698.

Dugès, Prof. A. (Guanajuato, Mexico). Specimens of reptiles comprising *Eutainia flavilabris* Cope, *Eutainia insigniarum* Cope, *Spea multiplicata* Cope, and *Leptodactylus microtis* Cope; radiates, crustaceans and worms; shells, comprising specimens of *Cerithium maculosum* Kierer, W. C. Mexico, *Mytilus hamatus* Say, and *Helix aspersa* Linn., from Chapultepec; birds' skins comprising specimens of *Picolates leucogaster*, *Lechuza parda* Vera Cruz=*Syrnium virgarum* Cassin, *Gallina del moate* (Perdicide) Vera Cruz=*Dendrortyx* and *Macrurus* (Jardine & Shelby); mammals, fishes, consisting of *Characodon ferrugineus*, *Characodon variatus*, *Hudsonius altus*, *Zophendum australe*, *Acara* sp., and *Lampetra spadicea;* specimens of plants and insects (24727); skin of orange-crowned warbler *Helminthophila celata* (25736); four specimens of *Polybia parvula* (25780).

Dumble, E. T. (See under Interior Department. U. S. Geological Survey.)

Dunton, Capt. J. J. (See under Treasury Department. U. S. Life-Saving Service.)

Durock, P. H. (General manager of the Pecos Red Sandstone Company, Pecos, Texas). Two four-inch cubes of red sandstone. 25390.

Eakins, L. G. (U. S. Geological Survey). Specimen of native gold in quartz from Potomac Mine, Montgomery County, Maryland (24809); gadolinite from Llano County, Texas. 24989.

Eaton, Miss Lucy C. (Truro, Nova Scotia). Cocoons of moth, *Tinea pellionella* L., and a specimen of the work of the insect. 25732.

Edwards, Dr. A. M. (Newark, N. J.). Specimen of diatomaceous earth. 25511.

Edwards, Vinal N. (Wood's Holl, Mass.). Specimen of American scoter (*Oidemia americana*). 25531.

Eells, A. F. (See under Dole Brothers.)

Eglеston, Prof. Thomas (School of Mines, Columbia College, New York City). Twenty specimens of minerals from various localities. Exchange. 25456.

Eichhoff, Dr. William (Strassburg, Germany). Typical specimens, representing 100 species of North American and exotic *Scolytidæ*, all new to the collection. Exchange. 25498.

Eldon, Charles H. (Williamsport, Pa.). Photograph of mounted animals. 25303.

Elkington & Company (London, S. W., England). Electrotype reproduction of Tycho-Bache's quadrant. Purchase. 24885.

Elkins, Richard (Halliehurst, Elkins, W. Va.). Specimen of albino chipmunk (*Tamias striatus*) in the flesh. 25776.

Elson, A. W., & Company (Boston, Mass.). Set of illustrations of "Photogravure Gilbo." Purchase. 25284.

EMMONS, Lieut. GEORGE F., U. S. N. (Sitka, Alaska). Fish-knife. 25560.

EMMONS, HAMILTON (Leipsic, Germany). Photographic views in Egypt, collected by Mr. S. R. Koehler, U. S. National Museum. 25347.

ENDLICH, Dr. F. M. (Ouray, Colo.). Specimens of pyrargyrite in quartz, polybasite from Yankee Boy Mine, and alaskite from the Alaska Mine, Poughkeepsie Gulch, collected by Prof. S. L. Penfield, of the U. S. Geological Survey. 24772.

ENGEL, LOUIS (New York City). Collection of Ute and Arapahoe Indian objects, cowboy costumes, Mormon photographs, and photographs illustrating the cattle industry. Purchase. 24548.

ENGINEERING NEWS (New York City), through A. M. Wellington. Complete set of samples of ramie and cloth made from the same. 25353.

ENGLE, HORACE M. (Roanoke, Va.). Specimen of scorodite. 25728.

ENGLISH, GEORGE L., & CO. (New York City). Specimens of calcite paramorph after aragonite, minium, hauerite, 3 jade cameos, cut specimen of beryllonite and cut specimen of sphene. 24760. Exchange.

EPSTEIN, JUSTUS (Reading, Pa.). Copy of the Hebrew Pentateuch in manuscript, with cloaks and pointer. Deposit. 25602.

EVANSVILLE PRESSED BRICK COMPANY (Evansville, Ind.). Two vitrified paving-bricks. 25854.

EVERETT, F. M. (Washington, D. C.). Carib stone hatchet from the Island of Navassa (deposit) (24648); eggs of *Fregata aquila*, *Sula sula*, *Anous stolidus*, *Sterna anæthetus*, *Columba leucocephala* from the same locality (gift) (25328).

EVERMANN, Prof. B. W. (U. S. Fish Commission). Two pieces of fossil wood from near Galveston, Tex.; 2 specimens of *Anabrus simplex* Hald., collected at Missoula, Mont. 25327. (See under Fish Commission, U. S.)

FAIRCHILD, Prof. H. L. (See under Otis and Gorsline.)

FAGAN, THOMAS C. (Washington, D. C.), through Barton A. Bean. Specimen of sphinx-moth (*Amphion nessus* Fab.). 25752.

FARMER, A. M. (Amoskeag, N. H.). Human skull, pelvis, base of spine, four leg-bones, and two arm-bones. 25329.

FARNHAM, A. B. (Benning, D. C.). Adult opossum and thirteen young, *Didelphys marsupialis*, in flesh. Purchase. 24781.

FARRINGTON, Dr. O. C. (New Haven, Conn.). Geological material from Guilford (24581); specimen of gneiss containing chrysoberyl, garnet, and iolite from Guilford and Haddam (24639). Exchange.

FERGUSON, WILLIAM T. (Washington, D. C.). Spider (*Eperia insularis* Hentz). 24979.

FERRISS, JAMES H. (Joliet, Ill.). Shells from Kansas and Illinois. 24632.

FERRY, Mrs. C. M. (Oneida, N. Y.). Sample of small-eared calico variety of popcorn. 24555.

FEWKES, Dr. J. WALTER. (See under Hemenway Southwestern Archæological Expedition, and Mrs. Mary Hemenway.)

FICK, G. A. (Baltimore, Md.). Pigeon in the flesh. 24733.

FIGGINS, J. D. (Washington, D. C.). Collection of reptiles and batrachians chiefly from the District of Columbia (24800); 3 snakes, *Cyclopis æstivus*, *Carphophiops amœnus*, *Bascanion constrictor*, and a salamander, *Spelerpes guttolineatus* (24955).

FILLETTE, Lieut. F. G., U. S. Navy (Washington, D. C.). Cane of palm-wood, gold mounted, with tusk of wild boar as handle; presented to Mr. Fillette by His Majesty Kalakaua, King of the Hawaiian Islands (deposit) (24660); 7 pictures illustrating the Chinese idea of the war in Tonkin, and a show-bill, "Chiarinis Show in China" (gift) (24739).

FIRST JAPANESE TRADING COMPANY (New York City). Bronze and 4 pottery figures. Purchase. 25880.

FISH COMMISSION, U. S.

(Through Col. McDonald, Commissioner, and Prof. Edward Linton): Specimens of avian entozoa from Yellowstone Park (24842).

FISH COMMISSION, U. S.—Continued.

(Through Col. McDonald): Fishes for skeletons, including carp (*Cyprinus carpio*), toad-fish (*Batrachus tau*), file-fish (*Alutera schoepffi*), spot (*Liostomus xanthurus*), sailor's choice (*Pomadasys fulvomaculatus*), California salmon (*Onchorhynchus chouicha*), and *Rurettus temminchii* (24959); collection of reptiles and batrachians made by Prof. B. W. Evermann in Montana and Wyoming in 1891 (25022); 10 specimens of fishes, comprising *Serranus atrarius, Menticirrus nebulosus, Cynoscion regale, Clupea harengus, Merlucius bilinearis, Phycis chuss, Lophopsetta maculata, Esox lucius, Cottus octodecimspinosus* and *Pomoxis* (25055); plants from Alaska collected by the steamer *Albatross* during the cruises of 1889 and 1890 (25079); plants from the Galapagos Islands, obtained during the cruise of the *Albatross* under the direction of Prof. Alexander Agassiz (25080); specimens of nuts and orchila from the Galapagos Islands, collected by the steamer *Albatross* during the cruise of January to April, 1891, under the direction of Prof. Alexander Agassiz (25084); fishes consisting of *Micropterus dolomieu, Lampris luna, Phycis, Brosmius brosme, Pleuronectes americanus, Pollachius carbonarius, Cottus octodecimspinosus*, and a turtle, *Aspidonectes spinifer* (25121); birds' skins from the Galapagos Islands and Alaska, collected by Mr. C. H. Townsend, naturalist of the Fish Commission steamer *Albatross*; skin of coast fox, *Urocyon virginianus littoralis* from Santa Rosa Island, California, and birds' eggs from Alaska, also collected by Mr. Townsend (25154); birds, rocks, lizard, insects, birds' skeletons, birds' nests, collected during the southern cruise of the steamer *Albatross* between January and April, 1891, under the direction of Prof. Alexander Agassiz, comprising the following specimens:

Birds: Chatham Island. *Nesomemus molanotis* Gould, *Dendroica aureola* Gould, *Geospiza fortis* Gould, *Geospiza fuliginosa* Gould, *Camarhynchus prosthemelas* Scl. and Salv., *Myiarchus magnirostris* Gray,[*] *Pyrocephalus minimus* Ridg. Charles Island. *Dendroica aureola* Gould, *Geospiza fuliginosa* Gould, and *Pyrocephalus manus* Gould.

Rocks from Chatham Island, Galapagos (east side), Malpelo Island, Cocos Island, Duncan Island, and Panama reef.

Lizard: *Amblyrhynchus cristatus.*

Birds' skeletons: Skeleton of *Creagrus furcatus* from Malpelo Island, and of *Oceanodroma melania* from the Gulf of California.

Birds' nests: Nest of *Geospiza* from Charles Island, and one from Duncan Island.

Order orthoptera. Specimen of a large locustid belonging to the genus *Meroncidius.*

Order homoptera. Two specimens of a Cicada, genus *Tibicen ?*

Order scorpionidæ. Specimen of *Centrurus* sp. Galapagos Islands.

Order coleoptera. *Calosoma galapagoum* Hope. Chatham Island, seven specimens; Charles Island, nine specimens. *Dermestes carnivorus* Fabr. Chatham Island, specimen of our well-known species. *Passalus* sp. Chatham Island, one specimen.

Order lepidoptera. *Agraulis vanillæ* L. var. *galapagensis* Holl. Chatham Island, two specimens; Charles Island, three specimens; Duncan Island, one specimen. *Callidryas eubule.* Chatham Island, one specimen; Charles Island, four specimens. *Lycæna* sp. Chatham Island, two specimens. *Aellopos titan* Cram. Chatham Island, one specimen. *Deilephila lineata* Fab. Charles Island, one specimen. *Proto parce* sp. Chatham Island, one specimen. *Eudamus* sp. Chatham Island, three specimens; Duncan Island, two specimens. *Eudamus* sp. Chatham Island, one specimen. *Utetheisa ornatrix.* Chatham Island, one specimen; Charles Island, two specimens.

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[*] See Proceedings of the National Museum, Vol. XII, No. 767, 1889, page 113 in text.

Fish Commission, U. S.—Continued.

Castnia sp. Chatham Island, one specimen. *Melipotis* sp. Duncan Island, three specimens; Chatham Island, six specimens; Charles Island, two specimens. *Schinia* sp. Charles Island, one specimen. *Sphingides* sp? (larva). Charles Island, five specimens; Chatham Island, one specimen; Charles Island, seven specimens. *Noctuid* sp.? (larva). Charles Island, in numbers. Geometrid sp.? (larva). Chatham Island, four specimens.

Order orthoptera. *Gryllus* sp. Charles Island, one specimen. *Schistocerca melanocera* Stal. Charles Island, seven specimens; Indefatigable Island, one specimen. *Schistocerca* sp. Chatham Island, four specimens. *Schistocerca* sp. (larva). Chatham Island, four specimens; Charles Island, six specimens. *Trimerotropis placida* (?) Hal. Chatham Island, four specimens; Charles Island, two specimens.

Order hemiptera. Pentatomid (larva). Chatham Island twenty-three specimens.

Order hymenoptera. *Xylocopa* sp. Chatham Island, one specimen; Charles Island, two specimens.

Order araneæ. *Epeira cooksonii* Butler. Chatham Island, one hundred specimens; Charles Island, twenty specimens; Indefatigable Island, four specimens. *Gasteracantha insularis* Thorell. Chatham Island, three specimens; Indefatigable Island, four specimens. *Scolopendra galapagoensis* Boll. Chatham Island, one specimen (25157); 4 photographs of Alaskan Indians and their houses (25162); fishes consisting of *Citharichthys sordidus*, *Paralichthys californicus*, *Pleuronectes stellatus*, *Psettichthys melanostictus*, *Sebastichthys auriculatus*, *Ophiodon elongatus*, *Raia ocellata*, and *Batrachus tau* (25193); 7 specimens of fishes comprising *Pleuronectes americanus*, *Roccus chrysops*, *Roncador stearnsi*, *Pleuronectes stellatus*, *Ophiodon elongatus*, and *Oncorhynchus chouicha* (25370); 955 specimens, representing 15 species of fishes, including *Leuciscus gilli*, a new species collected in Montana and Wyoming during the summer of 1891, by a Fish Commission party under the direction of Prof. B. W. Evermann (25434*); alcoholic specimens representing three species of lizzards from Cozumel Island, off the coast of Central America obtained by the Steamer *Albatross*, and alcoholic specimens of shells from Cozumel Island, collected in 1885 (25445); tarpon and bastard logger-head turtle (25494); collection of crustaceans made chiefly in the North Pacific Ocean by the steamer *Albatross* during the past three or four years (25547); 7 specimens of fishes consisting of *Lutjanus blackfordi*, *Haploidonotus grunniens*, *Pomadasys virginicus*, *Epinephelus morio*, *Ictiobus bubalus*, and *Stoasodon narinari* (25570); crustaceans collected at different times by the Fish Commission vessels on the Atlantic and Pacific coasts (25650); 117 birds' skins from the Galapagos Islands, collected in March and April of 1891 by the steamer *Albatross*, under the direction of Mr. C. H. Townsend; skin and skull of brown bear, shot at Port Moller, by Mr. Townsend, during the summer of 1890 (25708).

Through Mr. Richard Rathbun, acting commissioner: Small collection of crustaceans, consisting of *Mithrax* (*Nemausa*) *spinipes* (Bell), *Mithrax* sp. n., *Pericera* sp. n. *Pericera cornuta cœlata* (A. M. Edw.)., *Libinia* sp. n., *Libinia emarginata* Leach, *Libinia dubia* M. Edw., *Eupagurus splendescens* (Owen), obtained chiefly from the dredgings of the steamer *Albatross* in the Pacific Ocean, but including a few specimens from the Atlantic Ocean (24754).

Through Prof. B. W. Evermann: Collection of reptiles and batrachians from Missouri and Texas, obtained by him during the fall of 1891, and deposited in the museum (25311). (See under H. P. Thompson.)

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*A report on these fishes will be published in the Fish Commission Bulletin. The report has been recently submitted to Congress by Prof. Evermann.

Fisher, Dr. A. K. (See under Fred. Fowler.)

Fisher, Dr. H. I. (Lebanon, Ohio). Chain-link, supposed to have been broken by lightning. 25815.

Fitzgerald, J. C. (Greenville, S. C.). Jointed or glass snake. Purchase. 25484.

Fleming, J. W. (Silver City, N. Mex.), through G. P. Merrill, U. S. National Museum. Rubbing-stone for dressing hides, from Thompson County. 25308.

Florida Phosphate Company (Phosphoria, Fla.), through W. S. Warner. Samples of phosphate rock from various localities in Florida. 24676.

Foote, A. E. (Philadelphia, Pa.) Specimen of meteoric iron and meteoric iron altered to limonite from Cañon Diablo, Arizona (purchase) (24751); specimen of anglesite and one of matlockite .from Cromford, Derbyshire, England (exchange) (25203); two specimens of calcite from Guanajuato, Mexico (purchase) (24205).

Ford, Hon. J. C. (See under Kingston Exposition, Bahama Court.)

Forest and Stream Publishing Company (New York City). Head and tail of Atlantic salmon (*Salmo salar*) from the mouth of the Cabbassaconite River. Sent to the company by Mr. John T. Richards, of Gardiner, Maine. 25170. (See under V. L. Tiphaine.)

Forrer, R. (Strassburg, Germany). Specimens of Arentine pottery and Coptic cloth. Purchase. 24690.

Forrester, Robert (Scofield, Utah). Specimens of pectolite pseudomorph after leucite; pectolite and aragonite (satin spar), ores and other material from Utah (24611); specimens of wurtzillite (25324).

Fosdick, Charles R. (Washington, D. C.). Starfish with nine rays. 25094.

Fowler, Fred. (Fort Huachuca, Ariz.), through Dr. A. K. Fisher. Nest and 2 eggs of vermilion flycatcher (*Pyrocephalus rubineus mexicanus*). 25726.

Fox, William J. (Academy of Natural Sciences, Philadelphia, Pa.), through Prof. C. V. Riley, thirty-three specimens, representing 20 species of North American aculeate hymenoptera, mostly new to the collection (gift) (24873); 2 specimens of *Calliopsus abdominalis* Coues, and a type specimen of *Miscophus americanus* Fox, new to the collection (gift) (25364); collection of aculeate hymenoptera, consisting of about 4,000 specimens (including types of 25 species of Fox), and 100 exotic species (purchase) (25769).

Francis, Joseph (Minneapolis, Minn.). Silver medal presented to him in 1867 by the citizens of Fluenen, Lake Lucerne, Switzerland. 25281.

Francis, J. M. (See under James J. Clark.)

Frost, L. L. (Susanville, Cal.). One hundred and sixty-five small rude implements, arrow and spear-heads, principally of obsidian; small pebble with groove, probably used as a line-sinker; and a polished stone object. 25252.

Fulton, Hugh (London, England). Specimens of *Voluta aulica* L., from the Indo-Pacific Ocean. Exchange. 24697.

Gaffield, Thomas (Boston, Mass.). Collection of photographs. 25382.

Garman, Prof. S. (See under Museum of Comparative Zoölogy, Cambridge, Mass.)

Garner, Jesse (Washington, D. C.). Screech owl (*Megascops asio*). 25215.

Garner, R. L. (Salem, Va.). Two specimens of shark-pilot (*Echeneis naucrates*) from Wrightsville Sound, North Carolina (24625); Cypress roots and knees (24700); three teeth of shark, *Lamna cuspidata*; tooth of shark, *Hemipristis serra*; horn supposed to belong to Virginia deer, *Cariacus virginianus*; and bos of some unknown species from the phosphate bed on Ashley River, South Carolina (25124). (See under J. H. Williams.)

Gatschet, A. S. (Bureau of Ethnology). Specimens of Indian food collected in 1877 from the Klamath Indians (24702); winnowing-basket, *Shaplash*, made in 1877 by an Indian belonging to Klamath Reservation, southwest Oregon (25071).

Geisler, Bruno (König. Fuss-Gendarme, Laurahütte, Ober-Schlesien, Germany). Skins of 5 specimens of New Guinea mammals, and a skull of *Sus niger;* 29 spec-

GEISLER, BRUNO—Continued.
imens, representing 7 species of Birds of Paradise from New Guinea. Purchase. 25869.

GEOLOGICAL SURVEY OF CANADA (Ottawa, Canada), through Henry M. Ami. Black-nosed dace (*Rhinichthys atronasus*) from the cave and Hot Springs at Banff, in the National Park of Canada, Rocky Mountains. 25236.

GRIFFIN, JOHN C. (Ford's Depot, Va.). Eighteen leaf-shaped implements, and 90 arrow and spear-heads, mostly of quartzite, from an ancient Indian village site on Mill Quarter Estate, Amelia County. 24757.

GIBBES, Prof. LEWIS R. (Charleston, South Carolina). Four specimens of *Panopeus würdemannii* Gibbes (types) from Florida. 24977.

GIDDINGS, Miss BERTHA S. (Mills College, Cal.), through Prof. Josiah Keep. Water-color sketches of 6 species of Californian nudibranchs. 24858.

GIDDINGS, CHARLES F. (Washington, D. C.). Nest of hornet (*Vespa maculata L.*). 25000.

GIGLIOLI, Prof. HENRY H. (See under Royal Zoölogical Museum, Florence, Italy.)

GILBERT, Prof. CHARLES H. (See under William Millmore.)

GOLSON, EDWARD S. (South Saginaw, Mich.). Silurian corals from the drift near Saginaw (25061); 10 chipped disc and rude implements (25360).

GOOD, Rev. A. C. (Gaboon, West Africa). Collection of objects illustrating the life and manners of the Fang tribe, and a number of musical instruments. Purchase. 25654.

GOODE, Dr. G. BROWN (Assistant Secretary Smithsonian Institution, in charge of National Museum). One number of the Analectic Magazine for July, 1819, with two illustrations (25676); mezzotint by Peter Pelham, and an engraving by T. D. Booth (25685); 6 parchments containing Jewish marriage contracts and liturgies (25771); engraved copper plate "Port of Raph. Morghen,' by Cinelli, and an impression made from the plate (25848). (See under Smithsonian Institution. U. S. National Museum.)

GOULD, Dr. H. W. (San Diego, Cal.). Four specimens of silver ores from the Calico District, San Bernardino County, sent by request of Mr. F. W. Crosby, of Washington, D. C. 24638.

GRAM, N. C. (Dyrefjord, Iceland.) Two ladies' side-saddles, one dated 1789, and the other supposed to be 250 years old. 24932.

GRANIER, Emil (New York City). Collection of ethnological specimens from Rawlins, Wyo., consisting of Buffalo mask, fine model of tent (painted and complete), flute, medicine-man's wands, moccasins, wheel game, stone hammer, eagle-bone whistle, and numerous other articles. Exchange. 24931.

GRANT-BEY, Dr. JAMES (Cairo, Egypt). Two glass Arab lamps. 25741.

GREGER, A. (Russian legation, Washington, D. C.). Photograph of a Russian villager. 24896.

GREEGOR, ISAIAH (Jacksonville, Fla.) Marine shells chiefly from the Indo-Pacific Ocean (gift) (25159); dried barnacles from Nassau, Bahama Islands (gift) (25529); punched lantern used in 1822 (gift), and pathologic and dressed shells (exchange) (25714).

GREEN, ASHDOWN (Victoria, British Columbia). Fine specimen of *Chirolophus polyactocephalus*. 24711.

GREEN, BERNARD R. (Washington, D. C.). Thirty-three lantern transparencies of heads of human race, built into the Library of Congress. 25727.

GRÖNDAL, BENJAMIN (See under Icelandic Natural History Society.)

GROTTENTHALER, V., & Co. (Philadelphia, Pa.). Twelve pipe tools. Purchase. 25582.

GURLEY, O. A. (Cleveland, Ohio), through Mr. George C. Maynard. Morse register, belonging to the Old Time Telegraphers' Collection. Deposit. 25098.

GURLEY, R. R. (U. S. Fish Commission). Land and fresh-water shells from Texas (25267); hammock from Moravia (25397).

HADDON, Prof. A. C. (Royal College of Science for Ireland, Stephens Green, Dublin, Ireland). Collection of ethnological objects from Torres Straits, Australia. 24726.

HALE, Dr. E. M. (Chicago, Ill.). Snake (*Osecola elapsoidea*), from Florida. 25595.

HALL, B. H. (Washington, D. C.). The Kearney Cross, Birney's Division (one of the thousand bronze decorations given by General Birney in 1862–'63 to his soldiers for bravery). 24966.

HALL, CHARLES H. (South Glastonbury, Conn.). Three specimens of feldspar. 24895.

HALL, Prof. C. W. (See under Prof. A. D. Meeds.)

HALL, I. T. H. (Colorado Springs, Colo.). Five photographs of human habitations. 25448.

HAMLIN, Dr. A. C. (Bangor, Me.). Ten cut specimens of tourmaline and 19 of red and green tourmaline, quartz, and cassiterite. Exchange. 24943.

HAND, C. H. (Butte, Mont.), through Messrs. Packard and Melville, of the U. S. Geological Survey. Specimens of granite with native copper and copper oxide from Rice's Addition mine. 24797.

HANSKE, E. A. (Bellevue, Iowa). Arrow-head, drill, specimen of crinoid and shell (24938); 3 concretions (25377).

HANUKA, Pinkas (Washington, D. C.). Pair of Persian leather shoes and stockings. 24953.

HARBER, Lieut. G. B., U. S. Navy (Coast Survey). Fur clothing, consisting of coats, leggings, boots, pouch, mitts, hood, and boa, made by the Yokuti of North Siberia, and worn by Mr. Harber on the Lena Delta during his connection with the Jeannette relief expedition. 25334.

HARRAH, DAVID A. (See under Interior Department. U. S. Geological Survey.)

HARRIS, GEORGE E. (Cassville, Mo.). Larval and seven cave salamanders from Rock House Cave, Missouri (gift) (purchase) (24862, 25636).

HARRIS, GEORGE F. (London, England). Collection of eocene fossils chiefly from the Paris basin. 24771.

HARRIS, GEORGE H. (Rochester, N. Y.). Flint knife mounted in handle, and a blade. 25468.

HARRIS, JOSEPH A. (Moncton, New Brunswick). Limestone. 24612.

HART, G. B. (Baltimore, Md.). Pigeon in the flesh. 24649.

HART, J. C. (Union Point, Ga.), through J. L. Black. Magnetic ores. 24741.

HART, WILLIAM W., & Co. (New York City). Woolly monkey (*Lagothrix cana*) in the flesh (24567); baboon (*Cynocephalus*, sp.) in the flesh (24569). Purchase.

HARTMAN, J. M., through Mr. F. A. Lucas, U. S. National Museum. Specimen of calcite and quartz from Texada Island, Gulf of Georgia, British America 24801.

HARVEY, Rev. M. (St. John's, Newfoundland). Skin and skull of hooded seal (*Cystophora cristata*). 25783.

HASKINS WOOD VULCANIZING COMPANY (New York City), through Charles Bullman. Twenty samples of vulcanized wood. 25040.

HAY, Dr. O. P. (Irvington, Ind.). Two salamanders (*Spelerpes maculicaudus*) from Brookville, collected by Mr. E. R. Quick (24687); 4 salamanders (*Spelerpes bilineatus*) (24795); collection of snakes on which was based the donor's paper "On the Breeding Habits of Certain Snakes" (25652). (See under W. O. Wallace.)

HAY, Prof. **ROBERT** (Junction City, Kans.). Block of sandstone from dyke in northwest Nebraska (24784); photograph of a sandstone dyke in the same locality (24881); specimen of meteorite from Kiowa County (25254). (See under James Cowie.)

Hazen, Dr. D. H. (See under Robert Depue.)

Hazen, Mrs. **Mildred McLean** (no address given). Collection of ethnological objects consisting of pictures, buffalo-robe, pipes, bead-work, weapons, musical instruments, clothing, and other articles obtained from the Sioux Indians, and a number of objects from Alaska. Deposit. 25478.

Heald, F. E. (Manchester, N. H.). Infusorial earth from Chalk Pond, Newbury. 24716.

Healy, Capt M. A. (See under Treasury Department. U. S. Revenue Marine Service).

Heaton, **Charles** M. (Washington, D. C.), through George C. Maynard. Morse register and relay used in 1848, belonging to the Old Time Telegraphers' Collection. Deposit. 25119.

Hedley, **Charles**. (See under Dr. J. C. Cox.)

Hemenway, Mrs. **Mary** (Boston, Mass.), through Dr. J. Walter Fewkes. Twenty-three photographs of pottery, and a collection of ethnological and archæological objects from the table-lands of northeast Arizona. Deposit. 25631.

Hemenway Southwestern Archæological Expedition (Boston, Mass.), through Dr. J. Walter Fewkes. Three sheets of drawings of prints illustrating ceremonials of the Tusayan villages. 25338.

Hemphill, **Henry** (San Diego, Cal.). Skull of gray fox (*Urocyon virginianus*). 25011.

Henderson, J. C., **Jr.** (Washington, D. C.). Collection of crustaceans, shells, mollusks, snake, and 11 species of fishes from the west coast of Florida. 25300. (See under Charles T. Simpson.)

Hendley, **John** (Washington, D. C.). Two plaster casts of African horns. Purchase. 24886.

Hendricks, G. D. (Washington, D. C.). Drilled tablet found in Tipton County, Indiana. 25462.

Henkels, S. V. (Philadelphia, Pa.). Three stone objects from New Jersey. 25624.

Henshaw, H. W. (Bureau of Ethnology). A fine set of mounted herbarium plants representing the genera *Quercus*, *Aster*, and *Solidago*, from the District of Columbia (25291); collection of reptiles, batrachians, and fishes from Virginia and the District of Columbia (25322).

Herell, F. J. (Hunton Hill, Md.), through Mr. Robert Cohen. Young great blue heron (*Ardea herodias*) in flesh. 24618.

Herran, Hon. **Thomas** (Hamburg, Germany). Twenty-five gold ornaments from prehistoric graves in the Province of Antioquia, United States of Columbia, purchased by Mr. Herran at the request of the National Museum; carved stone from a cave near Sibate, Province of Cundinamarca, presented by Mr. Herran. 24547.

Herrera, Prof. A. L. (Mexico, Mexico). Small collection of alcoholic fishes from Matsoronga, Cordova, and Vera Cruz. 24769.

Higday, H. M. (Ingalls, Kans.). Insects. 24871.

Hilgard, Mrs. J. E. (Washington, D. C.). Sevrés vase presented by the French Government to Prof. Hilgard. 25172.

Hill, C. A. D. (Pensacola, Fla.). File-fish or fool-fish (*Monacanthus*). 25717.

Hill, R. T. (Austin, Tex.). Two samples of iron ore from Iron Mountain, Llano County. 24642. (See under Interior Department. U. S. Geological Survey; and Smithsonian Institution. National Zoölogical Park.)

Hill; Dr. T. Scott (Augusta, Me.). Eight archæological objects consisting of a flint implement, a flake of fine-grained quartzite from an Indian fire-place on the Kennebec River, and 6 rude flint implements found on the shore of Moosehead Lake, near Mt. Kineo, Me. 25858.

Hinds, J. E. (Brooklyn, N. Y.). Relief-block printing from blocks produced by screen process in November and December, 1878. 25649.

HITCHCOCK, FRANK (Department of Agriculture). Sparrow-hawk (*Falco sparverius*) in the flesh (25380); red-tailed hawk (*Buteo borealis*) (25481); sparrow-hawk (*Falco sparverius*) in the flesh (25493); sparrow-hawk (*Falco sparverius*), meadow lark (*Sturnella magna*) in the flesh (25530); meadow lark (*Sturnella magna*) in flesh (25540); meadow lark (*Sturnella magna*) and blue jay (*Cyanocitta cristata*) in the flesh (25544); tortoise, collected by Mr. E. A. Preble on the Potomac Flats, D. C.) (25574).

HITCHCOCK, ROMYN (U. S. National Museum). Six copies of the so-called "Peking Gazette," the oldest newspaper in the world, and now published daily in Pekin (gift) (25569); skull of walrus from Anadir Bay, Bering Strait (purchase) (25715). (See under Smithsonian Institution. U. S. National Museum.)

HITCHCOCK, Dr. T. S. (Oswego, N. Y.). Three photographs of carved powder-horns, inlaid table and a design for a monument. 25187.

HODGE, H. G. (York, Ill.). Specimens of beetles, *Canthon lævis* and *Onthophagus pensylvanicus*. 25799.

HOFFMAN, HARRY A. (Philadelphia, Pa.). Drum-major's staff, with case. 25270.

HOFFMAN, Dr. W. J. (U. S. Bureau of Ethnology). Collection of ethnological objects obtained from the Menomoni and other Indian tribes in Wisconsin and Minnesota, illustrating the arts and religious practices observed by them. Purchase. 24872. (See under Smithsonian Institution. U. S. Bureau of Ethnology.)

HOLMES, W. H. (Bureau of Ethnology). Three rude implements from an ancien Indian quarry, Indian Territory. 25224.

HOLZNER, FRANK X. (U. S. Army, Fort Snelling, Minn.). Two mice (*Sitomys leucopus* and *Sitomys michiganensis*), shrew (*Blarina brevicauda*), 3 specimens representing 3 species of birds' skins. 25042.

HOOD, JOHN H. (West Washington, D. C.). Fisherman's carved wood reel, formerly the property of William Hood, of Philadelphia. 24884.

HOOD, WM. (See under John H. Hood.)

HOPKINS, C. L. (Umatilla, Fla.). Three specimens of hog-nose snake (*Heterodon platyrhinus*). 25626.

HORNADAY, WILLIAM T. (Buffalo, N. Y.). Three skins of deer, *Cariacus* sp., from Texas. 24568.

HORNBROOK, R. L. (Butte, Mont.), through W. H. Melville, U. S. Geological Survey. Native silver in chalcocite, from Gagnon mine, Butte. 24804.

HOVEY, GEORGE U. S. (White Church, Kans.). Dorsal valve of *Productus symmetricus*. 25630.

HOWARD, E. L. (Herndon, Va.). Two specimens of asbestos from Hunter's Mills, Fairfax County. 24785.

HOWELL, E. E. (Washington, D. C.). Six cut and 2 rough opals from Queensland, Australia (24752); 40 specimens of ores from various localities (25277). Exchange.

HOY, Dr. P. R. (Racine, Wis.). Field-mouse (*Sitomys leucopus*). 25566.

HUBBARD, HENRY G. (No address given.) Two tadpoles from Great Salt Lake, Utah. 25666.

HUDDLESTON, JOHN R. (Kanawha Falls, W. Va.). Double-headed snake. Purchase. 24823.

HULSE, J. W. (See under J. C. Bird.)

HUNGATE, JOHN H. (La Harpe, Ill.). Inscribed stone. Deposit. (Returned.) 25524.

HUNNEWELL, ANNA. (See under Mrs. C. L. McCullongh.)

HUNT, Mrs. A. M. (Lamar, N. Mex.). Twelve specimens of silicified wood and a piece of lava. 25064.

HUNTLEY, JOHN (Sanel, Cal.). Specimen of fungus (*Merulius lachrymans*), found growing in the interior of a yellow fir tree, or Oregon pine. 25709.

Hurd, Gustine L. (Providence, R. I.). Buff stick used in daguerreotyping in 1857. 25296.

Hurter, Julius (St. Louis, Mo.). Specimen of *Coluber obsoletus* and one of *Engystoma carolinense* (24902); alcoholic specimens of reptiles and amphibians chiefly from St. Louis (25751); snakes from Alabama and Missouri (25873). Exchange.

Icelandic Natural History Society (Reykjavik, Iceland), through Benjamin Gröndal, president. Two wooden carved vessels used in eating, girdle with silver fibular, coat and head-dress forming portion of costume of a woman over 100 years of age. Exchange. 24633.

Ijima, Dr. J. (See under Science College Museum, Imperial University, Tokio, Japan.)

Ingle, Edward, (Washington, D. C.). Fetich taken from a negro prisoner at the city jail. 25163.

Interior Department.

U. S. Geological Survey (through Maj. J. W. Powell, Director). Specimen of wavellite from Steamboat Springs, Chester County, Pa. (24550); collection of fossil insects, described and figured by Prof. S. H. Scudder, of the Geological Survey, Vol. XIII, Hayden Reports (24593); through Prof. O. C. Marsh, 380 specimens of vertebrate fossils transferred from the Survey to the Museum (24627); minerals embracing pink grossularite, tridymite, orthoclase, sylvanite, emplectite, fluorite, mimetite, jamesonite, adularia, smoky quartz, tourmaline, wernerite, and strontianite (25090); fossil plants sent by Dr. J. S. Newberry, of Columbia College, New York City, to the Survey, and transferred to the Museum (25219); collection of vertebrate fossils from the estate of the late Dr. Leidy, of Philadelphia, Pa. (25345*); 43 specimens of minerals from various localities, consisting of agate, selenite, satin spar, calcite, fluorite, quartz, phlogopite, serpentine, chalcedony, massive apatite, stalactite, dolomite, calcite and kaolin in quartz geodes (25451); chalcedony from Frankfort, Ky. (25541); 2 specimens of bornite from the Gillis' Company's mine, Guilford County, North Carolina (25724).

Collected by Mr. Frank Burns: Specimen of pyrolusite from one mile east of Walnut Grove in Murphees Valley, Etowah County, N. C. (25851).

Collected by Dr. T. M. Chatard: Forty-six specimens of minerals from North Carolina, 10 specimens from Georgia, and 1 specimen from Pennsylvania, consisting of lucasite, asbestus, corundum, vermiculite, enstatite, talc, garnet, sunstone, andesite, diaspore, chrysolite, margarite, amphibole, and spinel (25260).

Collected by Mr. David Harrah, Burchard, Nebr.: Tooth of *Petalodus destructor*, a carboniferous selachian (25143).

Collected by Dr. Walter P. Jenney: four specimens of calcite, 2 specimens of sphalerite, 11 specimens of calamine, and 1 specimen of galena from Aurora, Mo. (24530); 19 specimens of pyrite, sphalerite, cerussite, and smithsonite from Galena, Kansas, and Sherwood, Jasper County, Mo. (24930); 44 specimens of galena, 15 specimens of sphalerite, and 12 specimens of calcite on galena from Joplin, Mo. (25024, 25174.)

Collected by Mr. W. Lindgren: thirty-four specimens of radiated brown tourmaline from Colfax, Nevada County, Cal. (25627).

Collected by Dr. W. H. Melville: twenty-nine specimens of minerals, consisting of barite, galena, plattnerite, garnet, and cerussite from near Mullan, Idaho (25034); minerals from Dillon, Mont. (25768).

Collected by Prof. S. L. Penfield: Specimen of hubnerite from North Star mine, and 2 specimens of guitermannite and zuñiite from Zuñi mine, near Silverton, Colo. (deposit) (24763); rock showing slickensides from Central Colorado (24789); 59 specimens of minerals from Colorado, consisting of aragonite, mimetite, cerus-

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* Deposit.

Interior Department—Continued.

site, pyrite, native gold, rhodochrosite, galena, orthoclase crystals, embolite, hyalite, and calcite (25261).

Collected by H. W. Turner: five specimens of garnet and 4 specimens of epidote (24192).

Collected by I. C. Russell: two pairs of snow-shoes from Charley's Village, Yukon River (25256).

Large collection, consisting of 10,566 specimens of cretaceous invertebrate fossils from Alabama, California, Colorado, Dakota, Mississippi, Montana, Oregon, Texas, Utah, Washington, and Wyoming, obtained by Messrs. G. F. Becker, C. B. Boyle, Frank Burns, C. B. Copeland, J. S. Diller, E. T. Dumble, R. T. Hill, L. C. Johnson, T. W. Stanton, R. W. Turner, C. D. Walcott, L. F. Ward, Walter H. Weed, C. A. White, and Bailey Willis. (See under C. W. Cunningham, Otto J. Klotz.)

Intram, Robert (Chenowith, Wash.). Centiped (*Chomatobius ruber*), and a milleped (*Chæromopus* sp.). 25535.

Ives, Fred. E. (Philadelphia, Pa.). Four specimens illustrating the making of a plaster mold from a swelled gelatine relief as used in the original "Ives process" (25526); composite helio-chromes (transparencies), arrangement of blue and yellow silk; 2 photographs from blue and yellow silk, chromo; 2 photographs taken from chromo, obtained through Mr. S. R. Koehler, of the U. S. National Museum (25534).

Ives, Nathan. (See under B. T. Nash.)

Jackson, F. Wolcott. (See under J. H. McCreery.)

Jackson, Thomas H. (West Chester, Pa.). Set of eggs of white-tailed ptarmigan (*Lagopus leucurus*) from Colorado. Purchase. 25045.

Jacobs Brothers (Washington, D. C.). Dog "Marco" in the flesh. 25284.

James, Joseph F. (Washington, D. C.). Catalogue of pictures and studies by Henry Mosler. The National Academy of Design, 1885. 25621.

Japanese Trading Company (New York City). Specimens of wood carvings, bronze, and banko figures. Purchase. 25235.

Jaquay, H. R. (Syracuse University, Syracuse, N. Y.). Specimens of *Oniscidæ*. Exchange. 24982. (For full entry see under O. F. Cooke.)

Jarvis, Lieut. D. H. (See under Treasury Department. U. S. Revenue-Marine Service, Capt. M. A. Healy.)

Javins, F. H. (Washington, D. C.). Snapper of grunter (*Lutjanus stearnsi*), crevalle (*Caranx hippos*), and Irish pompano or silver jenny (*Gerres gula*). 25367.

Javins & Company (Washington, D. C.). Sea-robin (*Prionotus carolinus*). 25710.

Jenks, Prof. J. W. P. (Brown University, Providence, R. I.), through Dr. George Marx, U. S. Department of Agriculture. Two specimens of *Olfersia*, n. sp. (found on a dead panther) from Florida; tree-frog, lizard, and snake from Indian River. 25812.

Jenny, Victor A. (U. S. Consular Agent, Macassar, Celebes). Violin, with bow, used by the natives in the interior of southern and eastern Celebes, guitar or mandolin from Dilli, Timor Island, frequently used by native Christians at Amboyna, and a native flute from the interior of Celebes; small shells found along the shore near Macassar; ethnological objects from Celebes, East Java, Islands of Bally, on the eastern coast of Lombok, Tenimber, and other adjacent islands. 25860.

Jenney, Dr. Walter P. (U. S. Geological Survey). Ores from Arkansas (25253); two specimens of cadmaniferous smithsonite from Morning Star Mine, Marion County, Ark. (25276); specimen of rubelite from San Diego, Cal., and one of kyanite from Windham, Me. (25422). (See under Interior Department. U. S. Geological Survey.)

Johnson, L. C. (U. S. Geological Survey). Fresh-water shells from Waddell's mill-pond, near Marianna, Fla. 24991. (See under Interior Department. U. S. Geological Survey.)

Johnson, Judge L. C. (Gainesville, Fla.). Specimens of scorpion (*Centrurus vittatus*). 25877.

Johnson, Prof. O. B. (University of Washington, Seattle, Wash.). Alcoholic specimens of hermit-crabs from Victoria and Port Townsend. 24584.

Johnson, S. B. (Shreveport, La.), through Frederick W. Mally, assistant entomologist, U. S. Department of Agriculture). Bone of alligator gar (*Lepidosteus tristœchus*), taken from under a strata of rock at Rocky Point, La. 24704.

Johnston, Miss F. B. (Washington, D. C.). Two silver prints in color; two photographic portraits of W. H. Fox Talbot, and a "World's dry plate camera" complete. 25319. (See under Alexander Beckers, George M. Bretz.)

Johnston, F. J. (New Carlisle, Ohio). Fragments of skull, bones, and three pieces of flint found in a gravel pit. 25633.

Jones, Dr. Levi (Zirconia, N. C.). Indian axe. 24996.

Jones, W. W. (Silver Cliff, Colo.). Specimen of cerussite and one of nadorite (?) with cerussite. 25368.

Jouett, Admiral and Mrs. James E. (Washington, D. C.). Dish and ewer of "precious metals," presented to Admiral Jouett for services rendered in saving from shipwreck the British steamship *Historian*, in the Caribbean Sea, in 1885. Deposit. 25680.

Jouy, P. L. (U. S. National Museum). Skin of otter (*Lutronectes* sp.), from Korea (24558); reptiles from Korea (purchase), and 71 birds' skins, representing 59 species from various localities (exchange) (24877). (See under Reverend R. T. Liston, George B. Marsh, Smithsonian Institution. U. S. National Museum, H. M. Stanley, Frank T. Woods.)

Kayser, William (Wapakoneta, Ohio). Specimens of coleoptera and lepidoptera, representing 25 species. 24631.

Kedzie, George E. (State Geologist, Ouray, Colo.). Specimen of rhodochrosite and mangan-dolomite, from Bear Creek, collected by Prof. S. L. Penfield, U. S. Geological Survey. 24741.

Keeney, Judge C. D. (Socorro, N. Mex.). Gypsum and siliceous sandstone. 25512.

Keep, Prof. Josiah. (See under Miss Bertha S. Giddings.)

Kelley, Lieut. John F. (Metropolitan Police, Washington, D. C.). Police baton carried by the Auxiliary Guard, a night police force of Washington, D. C., prior to 1861. 24817.

Kenaston, Prof. C. A. (See under Charles McLaren.)

Kerrison, C., jr. (Charleston, S. C.). Three models of fish-hooks. 24813.

Ketterlinus Printing House (Philadelphia, Pa.). Proof-book of a plate chromolithographed for Capt. Bendire's work on birds' eggs. 25579.

Kincaid, Trevor (Olympia, Wash.). Specimens of coleoptera, representing forty species, two of which are new to the collection (24663); four specimens of *Rosalia funebris* and one of *Zacotus matthewsii* (24909); specimens representing 142 species of coleoptera (25637).

Kingston Exposition (Kingston, Jamaica).

St. Vincent Court, through Mr. F. A. Ober. Collection of ethnological objects, native products, fish-traps, and other objects from the West Indies (25008).

Jamaica Court, through Mr. Welsh, commissioner at Kingston, and Mr. F. A. Ober. Collection of materia medica from the West Indies (25009).

Bahama Court, through Hon. J. C. Ford, commissioner at the exposition, and Mr. F. A. Ober. Collection of sponges from the West Indies (25010).

Kirsch, Louis. (See under Williamsburgh Scientific Society.)

Kline, William (Toledo, Ohio), through Mr. George C. Maynard. Morse telegraph register and key used in 1850, telegraph-insulators, and a specimen of twisted

KLINE, WILLIAM—Continued.
telegraph wire, belonging to the Old-Time Telegraphers' collection. Lent. 25096.

KLOTZ, OTTO J. (Preston, Ontario, Canada), through Interior Department U. S. Geological Survey. Specimen of amber on débris and one in winnowed débris from the shores of Cedar Lake, North-West Territories, Canada. 25190.

KNIGHT, M. D. (See under L. Vaden & Co.)

KOEBELE, A. (See under U. S. Department of Agriculture.)

KOEGLER, FRANZ (Brooklyn, N. Y.). Two specimens of photo-mechanical grain-work produced with screens made by the donor. 25746.

KOEHLER, S. R. (U. S. National Museum). Scale of tints from black to white, made by the donor. 25177. (See under Prof. Charles F. Chandler, Hamilton Emmons, Fred. E. Ives.)

KOST, Dr. J. (Tiffin, Ohio). Four fossils from Florida (24753); natural casts of septa of fossil Nautilus, *Nautilus zic zac* (24850).

KRAMER, WILLIAM V. (National Zoölogical Park). Copper coin of Dutch East Indies, 1858, and copper coin, 1 cent, of the British North Borneo Company. 24661.

KUNZ, GEORGE F. (Hoboken, N. J.). Collection of castings of figures, gypsy pots, kettles, and pitchers, a set of standard Russian weights, iron ores, and samples of sand from which castings are made, transmitted by Consul-General John M. Crawford, St. Petersburg, Russia. 25234.

LACOE, R. D. (Pittston, Pa.). The first installment of a collection of fossil plants, known as the Lacoe Collection. 25426.

LAMAR, T. G., & Co. (Langley, S. C.). Specimens of kaolin. 25211.

LAMB, T. F. (Portland, Me.). Fifteen specimens of minerals, consisting of muscovite, lepidolite, cassiterite, apatite, montmorillonite, sodalite, vesuvianite, feldspar, albite, beryl, and phanakite from various localities. Exchange. 24928.

LAMBUTH, J. W. (Cañon City, Colo.). Forty-two archæological objects from Kansas and Colorado. (Some presented and others deposited). 25536.

LANE, L. C. (Frankfort, Ky.). Fossil shells. Exchange. 25523.

LANGDALE, JOHN W. (Washington, D. C.). Eight minerals (exchange), 254 archæological objects, consisting of rude and leaf-shaped implements of quartz, quartzite and jasper, arrow and spear-heads of quartz, quartzite and felsite, and a stone hatchet partly polished (gift) (25452); peat from Oregon (gift) (25480); rocks from the District of Columbia (gift) (25673).

LATTIN, FRANK H. (Albion, N. Y.). Set of eggs of *Porzana jamaicensis*, and an egg of *Dendroica graciæ* (purchase) (25388); 4 modern gun-flints from an island in the Ohio River, near Pittsburg (25807).

LAUBACH, CHARLES (Riegelsville, Pa.). One hundred and eighty-seven archæological objects consisting of hammer-stones, rude jasper implements, and other material from "Durham, Indian Quarry," Bucks County (25149); 7 rude implements of jasper, and 2 arrow-heads from Weider Valley, Pennsylvania (25312).

LAWS, FRANKLIN (Windom, N. C.). Three specimens of arfvedsonite. 25772.

LEE, GEORGE (Washington, D. C.). Booted white fan-tail pigeon. 24980.

LEE, W. G. (Washington, D. C.). English fan-tail pigeons (24540, 24788).

LEIDY, Dr. (See under Interior Department. U. S. Geological Survey.)

LEIZEAR, H. H. (Sandy Spring, Md.). Red-tailed hawk (*Buteo borealis*) in the flesh. 25505.

LEIZEAR, W. G. W. (Sandy Spring, Md.). Two hawks in the flesh. 25280.

LEMON, Dr. J. H. (New Albany, Ind.). Eighty-four archæological objects from Clark and Floyd counties, consisting of rude-chipped implements, arrow and spear-heads, pitted and cupped stones, fragments of pottery, fossil and recent shells. Exchange. 25514.

LEONHARDT, PETER (Cabin John, Md.). Two species of snakes and a hog-nose snake (24956, 25596).

Lepp, Peter (East Saginaw, Mich.). Skin of blackburnian warbler (*Dendroica blackburniæ* (gift) (25564); 5 specimens, representing 5 species of owls (exchange) (25583); 3 screech owls (*Megascops asio*) (exchange) (25774).

Lettrick, E. F. (Mullan, Idaho). Pyromorphite with cerussite from St. Regis, Mont., collected by Dr. W. H. Melville, U. S. Geological Survey. 24933.

Lewis, George A. (Wickford, R. I.). American eider (*Somateria dresseri*) in the flesh. 25365.

Lewis, Merritt (U. S. Pension Office). Carved stone pipe found in Clinton County, Mich. 25309.

Lidgerwood, Mrs. John H. (Speedwell, Morristown, N. J.). Cup and saucer brought from Europe on the steamship *Savannah* by Capt. Moses Rogers, and presented to Judge Stephen Vail, of Speedwell, N. J., the maker of the machinery of the *Savannah*. 25201.

Lincoln, J. M. (New York City). Fossil teeth and vertebræ (25414); 2 vertebræ of fossil whale (25651).

Lindgren, W. (U. S. Geological Survey). Rocks and ores from Lake Valley, New Mexico. 25622. (See under Interior Department. U. S. Geological Survey.)

Lindsey, H. A. (Asheville, N. C.). Specimen of fergusonite from Madison County, N. C. Purchase. 24949.

Linton, Prof. Edward. (See under Fish Commission, U. S.)

Linton, W. J. (New Haven, Conn.). Two proofs from wood-engravings by the donor. 25259.

Liston, Rev. R. T. (Nogales, Ariz.), through P. L. Jouy, U. S. National Museum. Collection of reptiles (24608); specimen of coleoptera, 4 specimens of orthoptera, 1 specimen of hymenoptera, and 3 specimens of arachnida (24616).

Lippincott Company, J. B. (Philadelphia, Pa.). Five chromo-collographic and chromolith prints, illustrations of "yvernelle," etc. 25564.

Littlejohn, Chase (Redwood City, Cal.). Twenty-five birds' eggs from Alaska, representing 16 species, 2 eggs each of *Urinator lumme, Larus glaucescens, Dafila acuta, Ptychoramphus aleuticus, Simorhynchus pusillus, Oceanodroma leucorhoa, Sterna paradisæa, Ægialitis dubia, Tringa couesi;* an egg each of *Synthliboramphus antiquus, Lunda cirrhata, Fratercula corniculata, Cepphus columba, Larus brachyrhynchus, Olor columbianus, Haliæetus leucocephalus* (25518); 2 eggs of the rare Steller's duck (*Eniconetta stelleri*) from the mouth of the Yukon River, Alaska (25592); skin, nest and 4 eggs of Samuel's song sparrow (*Melospiza fasciata samuelis*) (25731); 2 birds' skins and 2 eggs (through Capt. Charles E. Bendire, U. S. A.) (25821).

Lloyd, Francis E. (Williams College, Williamstown, Mass.). Fish parasites, *Pandarus sinuatus* Say. 24914.

Lloyd, William. (See under Department of Agriculture.)

Logan, A. S. (Kansas City, Mo.). One hundred and forty-four chips, flakes, and other objects of limestone, and a stone pipe, together with a map or sketch of the mound from which the objects were taken. 25350.

Loomis, Rev. Henry (Clifton Springs, N. Y.). Reptiles, Japanese shells, crustaceans, radiates and sponges, about 80 fishes' skins, insects (*Scolopendra* sp.), from Japan (25379); 12 specimens of insects from Japan (25831).

Loomis, Leverett M. (Chester, S. C.), through Capt. Charles E. Bendire, U. S. Army, Eggs of *Bubo virginianus, Buteo lineatus, Parus bicolor,* and *Aix sponsa* from Chester, S. C. (24939); received direct from Mr. Loomis nine skins of mountain solitary vireo (*Vireo solitarius alticola*) from Cæsar's Head (25223); 20 birds' skins, representing 6 species from the same locality (25611).

Loper, S. Ward (U. S. Geological Survey). Augite rock from East Rock, New Haven (gift) (25200); 2 slabs of shale with rain-prints from Durham, Conn. (exchange) (25428); 6 specimens of banded jasper from Crown City, Colo. (gift) (25546).

Lord, A. W. (Jacksonville, Ill.). Eight specimens representing 8 species of birds' skins (25286); 9 birds' skins, representing 6 species (25409); 18 specimens of birds' skins, representing 11 species (25553); 14 birds' skins, representing 10 species (25784). Exchange.

Louderman, H. B. (St. Louis, Mo.). Shell of a lobster which weighed 23 pounds. 25156.

Love, Robert E. (Garrison, Tex.). Specimen of *Papilio ajax L.* 25743.

Lovett, Edward (Croydon, England). Curious old-style flint, steel, and sulphur matches from north Holland (gift) (24603); 8 oriental objects (four from India), consisting of a Hubble-bubble pipe, model of catamaran, armlet, carved stone vase, carved wooden box, decorated gourd for betel lime, pottery jug and body of stormy petrel used as a candle; 66 rude implements (paleolithic) and worked flakes from various localities in England (exchange) (25615).

Lowe, Braxton B. (Washington, D. C.). Living specimen of sphingid pupa (*Sphinx tetrio* Fab.?) collected at Key West, Fla. 25245.

Lowe, Camille (Knight's Ferry, Cal.). Specimen of robber-wasp (*Pepsis formosa* Say). 24882.

Lowe, Dr. James H. (Knight's Ferry, Cal.). Specimens of petrified wood, asbestus, moss opal, aventurine quartz crystals, and agate; eggs and newly hatched young of *Murgantia munda* Stal. 24723.

Lowenstein, Mr. William (Keokuk, Iowa). Specimens of *Leptura plebeja* and *Cantharis* sp. 25012.

Lucas, Frederic A. (U. S. National Museum) Two skeletons of snapping-turtle (*Chelydra serpentina*). 25471. (See under J. M. Hartman, W. H. Phillips.)

Luchs, Leopold (Washington, D. C.). Hebrew calendars, collected by Prof. Otis T. Mason, of the National Museum. 25362.

Luchs, Morris (Washington, D. C.). Three old-style pottery beer mugs from Augsburg, Bavaria. 24738.

Lynch, Alexander (Gainesville, Fla.). Kaolin from Bloomfield. 24604.

McCarthy, Gerald (Raleigh, N. C.). Stems and leaves of *Cabomba caroliniana* Gray. 25874.

McCormick, L. M. (See under Oberlin College.)

McCoy, Herbert N. (Richmond, Ind.). Salamander, *Plethodon cinereus erythronotus*. 24843.

McCreery, J. H. (Oceanport, N. J.), through F. Wolcott Jackson, general superintendent of the Pennsylvania Railroad, Jersey City. Four small shells found 20 feet below the surface in the marl beds of Monmouth County (25354); old-style lantern used by Edward Muschamp, a conductor on the Camden and Amboy Railroad, during the years 1830–'40 (25376); received direct from Mr. McCreery, fragment of foundation of Springfield quaker church in Burlington County, built in 1727; 91 specimens of cretaceous invertebrate fossils from the marl beds of Monmouth County, representing the species *Ostrea carva* Lamarck, *Terebratella plicata* Say, and *Belemnitella mucronala* Schlotheim (25543).

McCullough, Mrs. C. L. (Washington, D. C.). Miniature manuscript of the Lord's Prayer, written in 1836 by Anna Hunnewell, an armless woman, by holding the pen between the toes. 25489.

McDaniel, W. L. (Tyler, Tex.). Three specimens of *Unio anodontoides* var. with pink nacre. 25069.

McDonald, Col. Marshall. (See under Fish Commission, U. S.)

McFarlane, R. (Cumberland House, Saskatchewan, Canada). Skin of woodchuck (*Arctomys monax*), from near Cumberland House (24601); 69 specimens, representing 44 species of birds' skins, also 211 birds' eggs, and 50 nests, representing 21 species (25016); through Capt. Chas. E. Bendire, U. S. A., collection of fossil resin from the shores of Cedar Lake, Cumberland District, Saskatchewan Province, Northwest Territory of Canada (24594).

McGee, W. J. (U. S. Geological Survey). Silver ores from Mexico. 25195.

McGinniss, William H. (Youngstown, Ohio). One hundred and sixteen crystals of selenite from Ellsworth, Mahoning County, Ohio. 25056.

McGrath, J. E. (See under Treasury Department. U. S. Coast and Geodetic Survey.)

McGregor, R. C. (Denver, Colo.). Frog. 25243.

McGuire, J. D. (See under J. B. Morrow.)

McLaren, Charles (North West River, Hamilton Inlet, Labrador), through Prof. C. A. Kenaston. Crooked knife obtained from the Waskopie and Montagnais Indians of Labrador. 24973.

McLaren, William (U. S. National Museum). Irish "Shillalie." 25571.

McMillan, D. T. (Magnolia, N. C.). Fragment of a pottery vessel found about 3 feet below the surface of a marl-bed. 24582.

Mallery, Garrick. (See under Dr. Charles E. Woodruff, U. S. Army.)

Mally, Frederick W. (See under S. B. Johnson.)

Mantegazza, Paolo. (See under National Museum of Anthropology, Florence, Italy.)

Marks, M. L. (Washington, D. C.). Five gold ornaments from ancient graves in the United States of Colombia. 25150.

Markson, Philip A. (Herman's Ranch, Snake River, Oregon). Two specimens of copper ore from the Idaho side of Snake River (24735); cuprite and native copper from Little Bar, Snake River, collected by Dr. W. H. Melville, U. S. Geological Survey (24934); silver ore from Union County (25194).

Marron, Thomas (U. S. National Museum). Specimen of northern phalarope (*Phalaropus lobatus*) from Washington Navy Yard bridge. 24768.

Marsh, Prof. O. C. (See under Interior Department. U. S. Geological Survey.)

Marsh, George B. (Nogales, Ariz.), through P. L. Jouy, U. S. National Museum. Alcoholic specimen of iquana (*Ctenosaura multispinis?*), a rare species, new to the alcoholic collection. 24651.

Marsh, W. A. (Aledo, Ill.). Three species of unios from the Mississippi Valley. Exchange. 24841.

Marshall, George (Laurel, Md.). Specimen of woodhare (*Lepus sylvaticus*) in the flesh (24682); jumping-mouse (*Zapus hudsonius*) in the flesh (24793); star-nosed mole (*Condylura cristata*) (25618); garter-snake (25667); skin of purple grackle (*Quiscalus quiscula*) (25707).

Marshall, Henry (Laurel, Md.). Albino gray squirrel (*Sciurus carolinensis*) in the flesh (24564); common mole (*Scalops aquaticus*) in the flesh (24576); three blue Jays (*Cyanocitta cristata*) and a hermit thrush in the flesh (25331, 25497); whippoorwill (*Antrostomus vociferus*), and a blue jay (*Cyanocitta cristata*) in the flesh (25679).

Martin, Dr. D. S. (New York City). Two pieces of lignite from Disco Island, Greenland. 24755.

Martin, T. C. (New York City). Original sketch by S. F. B. Morse, showing circuit of telegraph between Boston and New York. 24901.

Marx, Dr. **George**. (See under Prof. J. W. P. Jenks.)

Mason, Prof. O. T. (See under Miss Irene S. Daniel, R. R. Gurley, Leopold Luchs.)

Matthews, R. E. (Roanoke, Va.). Specimen of *Citheronia regalis* Fab., with eggs. 25791.

Maynard, George C. (Washington, D. C.). Lithograph of Thomas A. Edison and of building in which first telegraph office was opened by Mr. Morse in Baltimore (deposit) (24944); two English dial-telegraph instruments, and a Kenosha telegraph-insulator, belonging to the Old Time Telegraphers' collection (gift) (25097); Morse telegraph-relay used in the year 1860 (deposit) (25413). (See under Paul D. Connor, O. A. Gurley, Charles M. Heaton, William Kline, I. N. Miller, W. A. Neill, and The E. S. Greeley Company.)

Meacham, Mrs. D. B. (Cincinnati, Ohio). Flint flake, four arrow-points, and a shell bead. Exchange. 25091.

Mearns, Dr. E. A., U. S. A. (Fort Snelling, Minn.). Shells, representing 48 species. 24840.

* **Mearns**, Dr. **Edgar** A., U. S. Army (International Boundary Commission, El Paso, Tex.). Birds' nests and eggs; small collection of fishes, consisting of *Moxostoma, Perca, Ictiobus, Clupea, Amiurus, Stizosteium, Lepidosteus, Haploidonotus, Dorosoma, Ictalurus, Ambloplites, Esox lucius, Pomoxis, Anguilla, Lepomis, Etheostoma, Umbra, Hybopsis*, and *Notropis;* 140 birds' skins, representing 78 species; mammal skins and skulls (25392); collection of mammal skins and skulls, cocoons of bag-worm (*Thyridopteryx* sp.), cretaceous fossils from El Paso, Tex.; 76 specimens of birds' skins representing 27 species (25578); collection of birds' skins, 16 specimens representing 2 species of birds' eggs, mammal skins, turtles (25823); rocks, birds' nest, eggs, birds' skins, mammal skins, specimens of *Helix* (25879).

Meder, **Ferd** (New York City). Engravings, consisting of the Head of Christ, Dürer; portrait, Van Sichem; Philip II, H. Wierix; Müller, Anton Graff; mezzotint of J. Ramsden, published January 1, 1791. Purchase. (25734).

Meeds, Prof. A. D. (University of Minnesota, Minneapolis, Minn.), through Prof. C. W. Hall. Stone slab from the Fort Union group of southern Montana, bearing the impressions of several leaves, among which is a specimen of *Populus*, new to science. Exchange. 25292.

Meigs, Gen. **Montgomery** C., U. S. Army (Washington, D. C.). Revolving rifle, in mahogany case, invented about 1835, made at Rochester, N. Y., by Billinghurst (gift) (24827); through Montgomery Meigs and Mary M. Taylor, executors of the estate of Gen. Meigs (bequeathed by Gen. Meigs and deposited in the Museum), seal ring with intaglio portrait of Julius Cæsar, an antique stone; large signet of bronze with stone engraved in intaglio; antique of Charon and Achilles or Æneas; silver tureen, part of silver service presented by the citizens of Baltimore to Commodore John Rogers in testimony of their appreciation of the important aid afforded by him in the defense of Baltimore on the 12th and 13th of September, 1814; silver teakettle presented to Capt. Montgomery Meigs, U. S. Engineers, by the corporation of Washington, with a resolution of thanks approved March 12, 1853, for his report on the Washington Aqueduct, presented June 9, 1854, by John W. Maury, mayor, Joseph Burrows, of the board of aldermen, and A. W. Miller, of the board of common council, committee of the corporation; cabinet of coins, medals, and other objects, the cabinet made of fragments of the wagons used by Gen. Sherman in the campaign of 1864 and 1865—including a collection of 137 colored glass reproductions of antique intaglio gems; plaster cast of a Thorwaldsen medallion; gold-mounted antique intaglio "Phebus in Chariot of the Sun;" 58 bronze and gilded medals, commemorating events in American and European history; 49 modern gold, silver, and copper coins of England, Germany, Mexico, Italy, and Spain; 254 silver and copper coins of ancient Greece and Rome; badge of the Union League Club of Philadelphia; medal given by the Grand Trunk Railway Company of Canada to persons distinguishing themselves in its service; bronze medal awarded to Gen. Meigs for the Cabin John Bridge by the Centennial Commission, 1876 (deposit) (25386); 7 colored sketches and 23 pencil sketches (gift) (25469).

Melville, Dr. W. H. (See under C. M. Allen, C. H. Hand, R. L. Hornbrook, E. F. Lettrick, Philip A. Markson, S. L. Pelkey, Interior Department, U. S. Geological Survey.)

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* A further reference to the collections made by Dr. Mearns for the National Museum, in connection with the International Boundary Commission, will be found in the chapter on Explorations.

MENDENHALL, Prof. T. C. (See under Treasury Department. U. S. Coast and Geodetic Survey.)

MENEFEE, SPEED S. (Louisville, Ky.). Specimen of native silkworm, *Telea polyphemus*. 24730.

MERRIAM, Dr. C. HART (Chief of Division of Ornithology and Mammalogy, Department of Agriculture). Four birds' skins, representing 2 species from Florida and Texas. Deposit. 25853. (See under Department of Agriculture, Smithsonian Institution, National Zoölogical Park.)

MERRILL, GEORGE P. (See under Prof. W. J. Brown, J. W. Fleming; Smithsonian Institution, U. S. National Museum.)

MERRILL, Consul-General SAMUEL. (See under Department of State.)

METCALF, H. D. (Landover, Md.). Bill of lading of the Philadelphia and Baltimore Citizens' Union Line of Transportation, April 18, 1840. 25258.

MICHAUD, Dr. GUSTAVE (San José, Costa Rica), through Prof. C. V. Riley. Thirty-three specimens, representing 16 species of insects of various orders from Costa Rica. 24874.

MIDDLETON, R. MORTON (South Pittsburg, Tenn.). Specimen of *Plethodon æneus*. 25755.

MILES, L. (Ashley, N. Dak.). Head of prairie hen (*Tympanuchus americanus*). 25662.

MILLER, CHARLES, Jr. (Grand Rapids, Mich.). Fossil shells and 5 small arrowheads. 25711.

MILLER, I. N. (Cincinnati, Ohio), through Mr. George C. Maynard. Morse telegraph key, belonging to the Old Time Telegraphers' Collection. Deposit. 25095.

MILLER, Capt. JAMES M. (Washington, D. C.). Original roll and muster of the Commander-in-Chief (Gen. Washington) guard for the month of July, certified by William Colfax, lieutenant in command; testimonial to good service and character of Baron de Arendt, from the War Office, Philadelphia, September 15, 1778. 25672.

MILLMORE, WILLIAM (Sitka, Alaska), through Prof. Charles H. Gilbert. Crab. 24776.

MINDELEFF, COSMOS (U. S. Bureau of Ethnology). Specimen of calcite pseudomorph after glauberite from Rio Verde, Ariz. 24988.

MITCHELL, GEORGE (Vancouver, Wash.). Nests of *Cinclus mexicanus*. (24615, 24670.)

MITCHELL, GUY E. (Washington, D. C.). Two hundred and fifty-two specimens of birds' eggs, representing 34 species. 25167.

MITCHELL, J. D. (Victoria, Tex.). Thirty-eight species of shells (25542); miscellaneous shells (25837).

MOFFETT, J. S. (Harrisonburg, Va.). Polished slab of stalagmite marble. 25240.

MOLLER, THEODORE (Washington, D. C.). War-club of the Ute Indians of Colorado. 24994.

MONKS, Miss S. P. (Los Angeles, Cal.). Recent and fossil shells. 25844.

MONTANDON, Prof. A. L. (Bucarest, Roumania). Two hundred and twenty-four specimens representing 76 species of Old World hemiptera, well preserved, authoritatively named, and new to the collection (24579); 30 species of exotic hemiptera (25244); 29 species of heteroptera (25520).

MONTGOMERY, S. H. (Portsmouth, Ohio). Forty flint implements from Ohio and Kentucky. Exchange. 25375.

MOONEY, JAMES (U. S. Bureau of Ethnology). Ethnological objects from the Piute Indians, consisting of a blanket of rabbit skins, 3 arrows, stick-game, fire-drill, body of decoy duck, and part of rush mat made by a Winnebago Indian. 254`8. (See under Smithsonian Institution. U. S. Bureau of Ethnology.)

MOOREHEAD, WARREN K. (Camp Hopewell, Anderson, Ohio). Altar made of baked clay from a mound on the north fork of Paint Creek, Ross County, Ohio. 25003.

MORCOM, G. F. (Chicago, Ill.). Cackling goose (*Branta canadensis minima*) in the flesh. 24986.

Moreland, Walter (Washington, D. C.). Specimen of *Larimus fasciatus* from Fortress Monroe (25742); cunner or blue perch (*Ctenolabrus adspersus*) (25794).

Morgan, T. H. (Byrn Mawr, Pa.). Specimens of crustaceans from near Jamaica, West Indies. 25373.

Morgan, W. J., & Co. (Cleveland, Ohio). Three specimens of chromo-lithographic poster work. 25875.

Morganton Land Improvement Company (Morganton, N. C.). Indian hatchet from Cherry Fields, specimens of almandite and of corundum altering to damourite from Burke County, and of corundum from Yancey County, collected by W. S. Yeates, of the National Museum. 24964.

Morrison, Prof. James H. (Luray, Va.). Bat from Virginia. 25457.

Morrow, J. B. (Ellicott City, Md.), through J. D. McGuire. Grooved ax from Cumberland County, Pa., and polished hatchet from Hardin County, Ohio. 24910.

Morse, S. F. B. (See under T. C. Martin.)

Moss, William (Ashton-under-Lyne, England). Specimens of *Bulimus acutus* with microscopic slides, and specimens showing serrated organ and details (24332); 12 microscopical slides of dentition of British mollusks (25387).

Mukharji, T. N. (See under Department of State.)

Murdoch, John (Washington, D. C.). Chromo-photogravure of a Spanish man-of-war (25333); pair of Eskimo winter mittens made of Polar bear skin from the village of Utkiavwiñg, near Point Barrow, Alaska (25515); hooded frock (Atige) (forming costume of a man), made of spotted skin of the tame Siberian reindeer, and a pair of highly ornamented full-dress boots of reindeer skin (25645); 8 bird skins, representing 7 species, from eastern Massachusetts (25716).

Murray, J. Ogden (Goshen, Va.). Arrow-heads (25087, 25545).

Murray, John (Edinburgh, Scotland). Eighty-nine specimens of hermit crabs from the Firth of Clyde. 25925.

Muschamp, Edward. (See under J. H. McCreery.)

Museum of Comparative Zoölogy (Cambridge, Mass.), through Prof. S. Garman. Two lizards from South Dakota (25031); alcoholic specimen of *Azeria panamensis* (25687). Exchange.

Museum of Fine Arts (Boston, Mass.). Modern impression from a fifteenth or sixteenth century wooden block in the possession of the Museum of Fine Arts. 24947.

Museum of Natural History (Paris, France). Forty birds' skins, representing 36 species, from Madagascar, the Phillipine, and other adjacent islands (25691); through Dr. E. Beauregard, skeletons of *Rhynchotus rufescens, Chauna chavaria, Ketupa leschenaulti, Sarkidiornis ægyptius, Psophia crepitans, Gyps fulvus, Turacus purpureus, Rhynochætus jubatus, Phalacrocorax urile*, 7 mammal skeletons, and an alcoholic specimen of Chimpanzee (24853). Exchange.

Muzzey, George E. (Lexington, Mass.). Silver medal of centennial celebration of the battle of Lexington, April 19, 1875. 24958.

Narrin, Mrs. M. L. (Goodrich, Mich.). Specimen of serpentine quartzite. 24621.

Nash, B. T. (Syracuse, N. Y.), through Hon. J. J. Belden. Cap owned and worn by Nathan Ives during the naval engagement between the *Kearsarge* and *Alabama*, sheath-knife and sailor's palm, also owned by Mr. Ives. 25148.

National Museum of Anthropology (Florence, Italy), through Prof. Paolo Mantegazza. Thirty-seven archæological objects from Italy. Exchange. 24919.

National Museum of Costa Rica (San José, Costa Rica). Four birds' skins, representing 2 new species (24644); through Mr. George K. Cherrie, type specimens of *Mionectes semischistaceus*, sp. nov., and *Ornithion pusillum subflavum* Sulph., nov. (24924).

Naval Eclipse Expedition (United States). Seven birds' skins, representing 2 species from Ascension and St. Helena Islands. 25700.

Neal, Dr. James C. (Lake City, Fla.). Eighteen arrow-heads and a perforator from Rabun County, Ga. 24656.

Neale, H. C. (U. S. National Museum). Specimens of quartzite from Potsdam, N. Y. 25255.

Neeb, F. C. (See under W. Seifert.)

Nehring, Prof. Dr. A. (Berlin, Germany). Five seeds of *Cratopleura helvetica* Nehringi, C. Weber, found in peat at Klingi. Exchange. 25510.

Neill, W. A. (Cleveland, Ohio), through Mr. George C. Maynard. Wade telegraph-insulator, belonging to the Old Time Telegraphers' collection. 25099.

Nelson, E. W. (Bishop Creek, Cal.). Skins and skulls of black bear, and three brown bears (24863); skins and skulls of three deer (25180).

Neumann, Dr. **Julius** (Hoihow, China). Two bronze drums or bells with wooden stands, collected by Mr. F. S. Unwin, of Canton, China (25266); collection of cocoanut ware, tools used for carving the shells, four hats, two bamboo lamps, 2 smoothing-irons, crockery ware, wine-cups, and chess-box (25712).

Neville, **William** R. (Houston, Tex.). Specimen of mole-cricket (*Gryllotalpa longipennis*). 25004.

Newberry, Dr. J. S. (See under Interior Department. U. S. Geological Survey.)

Newhall, W. H. (See under Smithsonian Institution. U. S. National Museum.)

Newport, Miss **Eddie** (Glasgow, Ky.). Living specimen of snake, *Cyclophis æstivus*. 24894.

New York State Museum (Albany, N. Y.), through Prof. J. M. Clarke. Duplicate specimens of fossils from the Rio de Janeiro Museum collection. 25670.

Niswander, F. J. (Laramie, Wyo.), through Prof. C. V. Riley. Fifty-two species of miscellaneous insects from Wyoming. 25357.

Noël, **Paul** (Rouen, France). Fifty insects from Europe. Exchange. 25269.

Norman, Rev. A. M. (Burnmoor Rectory, Fence Houses, Durham, England). Twenty-two species of European *Paguridæ* and *Pycnogonoida*. Exchange. 25506.

Northrup, Dr. G. J. (Marquette, Mich.). Iron ore. 25802.

Norton, **Arthur** H. (Westbrook, Me.). Seven bird's skins. Exchange. 25463.

Nuttall, Mrs. **Zelia** (Dresden, Germany). A painting, copy of an ancient Mexican feather shield. 24794.

Ober, F. A. (See under Kingston Exposition.)

Oberlin College (Oberlin, Ohio), through L. M. McCormick. Specimen of fruit bat (*Pteropus keraudrenii*). 24864.

Olivier, **Ernest** (Moulines (Allier), France). Specimens of *Photinus rigidus* Oliv., from Cape Breton. 25268.

Olney, Mrs. **Mary** P. (Spokane, Wash.). Shells. 25594.

O'Neill, **William** O. (Prescott, Ariz.). Lithographic limestone from Yavapai County. 25525.

Orcutt, C. H. (San Diego, Cal.). Specimens of *Solecurtus subteres*, *Solen rosaceus*, and *Siliqua lucida* from San Diego and Rodos Santos Bay, Lower California. 25840.

Ormsbee, E. L. (Cleveland, Ohio), through Mr. Robert Ridgway. Photograph of a brant with an Eskimo arrow through its wing. 24922.

Osborn, Prof. H. L. (Hamline University, Hamline, Minn.). Twenty-five shells. 24556.

Otago University Museum (Dunedin, New Zealand), through Dr. T. Jeffrey Parker. Crustaceans. Exchange. 25341.

Otis & Garsline (Rochester, N. Y.), through Prof. H. L. Fairchild. Sixty-four specimens of well-drillings from Rochester. 25062.

Owsley, Dr. W. T. (Glasgow, Ky.). Two snakes. 24821.

Packard, A. S. (See under C. M. Allen, C. H. Hand.)

Palmer, **Edward** (Washington, D. C.). Rocks, vegetable drugs, foods, tanned skins of Iguana, collection of ethnological objects from the Cocopa Yaki, White Mountain Apache, and Mexican Indians of Mexico and New Mexico, 208 archæological objects consisting of stone implements from the same locality, and fossil shells. Purchase. 24600.

PALMER, JOSEPH (U. S. National Museum). Skin of field-mouse (*Arvicola riparius*) (24560); 3 young meadow-mice in the flesh (24811).

PALMER, WILLIAM (U. S. National Museum). Two skins of common mole (*Scalops aquaticus*), from Baltimore; skin of rhesus monkey (*Macacus rhesus*) (24565); monkey (*Chrysothrix sciurea*) (25127); macaque (*Macacus* sp.) (25130); jendaya paroquet (*Conurus jendaya*) from Brazil (25164); jumping-mouse (*Zapus hudsonius*) from Balston, Va., in the flesh, collected by Willard Burch (25184). (See under Capt. W. H. Cassell.)

PARK, J. T. (Warner, Tenn.). Four specimens of bronzed grackle (*Quisculus quiscula æneus*). 24814.

PARKER, A. H. (Westbrook, Me.). Larvæ of dytiscid beetle and carabid beetle, alcoholic specimens of reptiles, skull of owl, *Nyctale tengmalni richardsoni*, alcoholic crustaceans and echini, 4 birds' skins, specimens of mammals, shells (25464); 8 tortoises from Stroudwater River (25632). Exchange.

PARKER, Dr. T. JEFFREY. (See under Otago University Museum.)

PARMELE, Mrs. THEODORE W. (New York City). Historical chart. 25558.

PARSONS, Miss KATHERINE (Washington, D. C.). Sedan chair formerly owned by the family of Louis XIV. Deposit. 25600.

PATRICK, ISAAC (Crown King, Ariz.). Male specimen of *Dynastes granti*. 24915.

PATTEE, T. B. (Valley Springs, Cal.). Set of eggs of yellow-billed magpie (*Pica nuttalli*) (25684); sets of eggs of *Falco sparverius, Colaptes caper, Pica nuttalli* (25757).

PATTON, W. (Cedar Creek, Mo.). Specimens of iron sulphide. 24674.

PAYN, ELIAS (Tres Piedras, N. Mex.). Sandstone. 25801.

PAYNE, ROBERT H. (U. S. Geological Survey). Enamel picture on glass, transferred from stone. 25093.

PAYNE, SAMUEL (Washington, D. C.). Monkey, *Cercopithecus* sp. 25682.

PEABODY MUSEUM (Cambridge, Mass.), through Prof. A. E. Verrill. Specimens of *Panopeus crenatus, transversus* and *planus*. Exchange. 25342.

PECOS RED SANDSTONE COMPANY (Pecos City, Tex.). Two 4-inch cubes of red sandstone. 25351.

PELKEY, S. A. (Huntington, Oregon). Opal (?), collected by Dr. W. H. Melville, U. S. Geological Survey. 25077.

PENCE, W. C. (Shenandoah, Va.). Insects (24865, 25070).

PENFIELD, Prof. S. L. (New Haven, Conn.). Minerals from various localities, consisting of lithiophilite, amblygonite, hureaulite, reddingite, triploidite, dickinsonite, natrophite, fairfieldite, scovillite, rhabdophane (25202); spangolite from Tombstone, Ariz. (25421). (See under Dr. F. M. Endlich, George E. Kedzie, Interior Department. U. S. Geological Survey, Tingley S. Wood).

PENNSYLVANIA RAILROAD COMPANY. Complete steel tie with rail and fastenings used on the road near Philadelphia (25532), through Joseph T. Richards, assistant chief engineer,plaster cast of a bronze tablet for the Bordentown monument, erected by the Pennsylvania Railroad to mark the first piece of track laid in the State of New Jersey, and also to commemorate the sixtieth anniversary of the first movement by steam in New Jersey (25337).

PENNYPACKER, C. H. (West Chester, Pa.). Five specimens of calcite from Bigrigg mine, Cumberland, England (24787); specimen of adamite, smithsonite from Greece, and corundum from Ceylon (25453). Purchase.

PENROSE, R. A. F., jr. Specimen of spessartite from Llano County, Tex. 25214.

PERKINS, F. S. (Madison, Wis.). Brass buckle of European manufacture, obtained from an Indian grave near Oshkosh. 25744.

PETERS, Dr. JOHN P. (New York City). Weaving-loom, card, and shuttle from Bagdad (25104); through Dr. Cyrus Adler, Turkish baker's tally from Broussa, in Asia Minor (25808).

PETERSON, N. (Salem, N. C.). Sample of corrugated applewood. 24765.

PETTIGREW, F. W. (Fort Pierre, S. Dak.). Fossil bone containing chalcedony (25513); skull of Arickaree Indian, and a large fragment of fossil bone (25721).

PFORDTE, OTTO F. (Jersey City, N. J.). Small lithological collection from New Jersey, California, Mexico, New Mexico, Bolivia, Peru, Saxony, Germany, and Arizona, and an Azaugar. 25278.

PHILLIPS, BARNETT (Brooklyn, N. Y.). "Petticoat lamp," a hand-lamp in which lard oil was burned. 25767.

PHILLIPS, H. H. (Crystal Falls, Mich.). Bird's egg. 25855.

PHILLIPS, W. H. (U. S. National Museum), through Mr. F. A. Lucas. Skull of cavy (*Cœlogenys paca*) from Nicaragua. 24613.

PHŒNIX IRON WORKS (Phœnixville, Pa.), through Amory Coffin. Chart of sections and shapes of rails rolled by the works, previous to 1862. 25735.

PICHER, Miss ANNIE B. (Pasadena, Cal.). Photographs of Padre Serra, a Mexican drawn-work maker; Father Serra's stirrup (Indian wood-carving), and drawn-work, showing "Little Jesus" stitch. 25019.

PICKLES, JULIAN (Dry Branch, Mo.). Nine specimens of barite and one specimen of calcite. 25239.

PIERCE, Hon. WILLIAM P. (See under Dr. J. F. Chittenden.)

PILSBRY, H. A. (Academy of Natural Sciences, Philadelphia, Pa.). Two specimens of *Vivipara georgiana* var. *altior* Pils., and one of *Prososthenii tournoneri* Newm. 25733.

PLEAS, C. E. (Clinton, Ark.). Mounted winter wren (*Troglodytes hiemalis*) (25417); 12 birds, representing 9 species (25778). Exchange.

POLLOCK, JOHN S. (Smithsonian Institution). Red-tailed hawk (*Buteo borealis*) in the flesh, from Shanklin, Va. (24866); Cooper's hawk (*Accipiter cooperi*) in the flesh, from the same locality (25242).

POND, Lieut. CHARLES F., U. S. Navy (Navy Yard, Mare Island, Cal.). Specimen of sphinx-moth (*Smerinthus ophthalmicus* Bd.). 25610.

POPE, H., (Southwest Point, Anticosti, Quebec, Canada). Skull of grey or horse-head seal (*Halichœrus grypus*). 25044.

PORTER, Capt. GEORGE D. (See under Miss J. N. Cooke.)

PORTER, Dr. J. H. (Army Medical Museum, Washington, D. C). Two human skulls, piece of bone, 4 stone implements from Rockingham County, Va. 24719.

PORTER, W. B. (Chicago, Ill.). Set of eggs of *Sterna maxima* from Key West, and one from near Biloxi, Miss. (25092); set of eggs of everglade kite (*Rostrhamus sociabilis*) from Dade County, Fla. (25185).

POTTER, Rev. J. A. (Fort Clark, Tex.). Large fresh-water shrimp (*Palæmon*). 25663.

POWELL, Maj. J. W. (See under C. W. Cunningham, Smithsonian Institution. U. S. Bureau of Ethnology, Smithsonian Institution. U. S. Geological Survey.)

POWELL, Maj. WILLIAM H. (Fort Keogh, Mont.), through Dr. D. P. Wolhaupter. Black stone pipe belonging to Washaki, a chief of the Arapahoes, and presented to Major Powell by him during the campaign of 1876. 25427.

PRATT, JOHN (Brooklyn, N. Y.). Model "Typewriter," invented in 1864 by John Pratt. Purchase. 25479.

PREBLE, E. A. (See under Frank H. Hitchcock.)

PRILL, Dr. A. G. (Sweet Home, Oregon). Nest and eggs of *Melospiza fasciata guttata*, and nest of *Troglodytes hiemalis pacificus* (24669); 2 skins of downy young of ring-necked pheasant (*Phasianus torquatus*) (24722); downy young of Cooper's hawk (*Accipiter cooperi*) from Oregon (24737); set of eggs of western house wren (*Troglodytes œdon aztecus*) (24921).

PRINGLE, C. G. (Charlotte, Vt.). Dried plants from Mexico (24614, 25883).

PRUDEN, ALFRED (Dayton, Ohio). Copper axe from an Indian mound, and teeth taken from a skull found in the same mound. 25113.

PURINTON, L. W. (Beaver, Kans.). Specimen of badger (*Taxidea americana*) from Trego County. Purchase. 25132.

PUTNAM, Prof. F. W. (See under Mrs. D. B. Spenser.)

PUTNAM, Mrs. WILLIAM (Lyker's, New York). Specimen of cecropia silk-moth. 25015.

QUELCH, BERTRAM (Wilmington, N. C.). Butterflies. 24870.

QUERRDO, ALEXANDER SAMUEL LAFONE (Pilciao, Catamarea, Argentine Republic), through Mr. George Salthouse, Fairfield, Liverpool, England. Fragments of pottery. 25299.

QUICK, E. R. (See under Dr. O. P. Hay.)

QUIVES, GEORGE A. (Washington, D. C.). Lizard. 25053.

RABBIT, SAMUEL (Washington, D. C.). Pouter-pigeon. 24836.

RAGSDALE, GEORGE H. (Gainesville, Tex.). Marine shells from the west coast of Mexico (24740); tail of cardinal (*Cardinalis cardinalis*) (25671).

RALPH, Dr. WILLIAM L. (Utica, N. Y.). Wolf (*Canis lepus griseoalbus*) (24575); skin of Cabanis' woodpecker (*Dryobates villosus hyloscopus*) from Colorado (24898); 14 birds' skins, representing 11 species from San Mateo, Putnam County, Fla. (25786); magnificent collection of birds' eggs, consisting of 1,630 specimens, representing 194 species and 444 sets, several of which are new to the collection; also 100 nests (25787); through Captain Charles E. Bendire, U. S. Army, 2 skins of saw-whet owl (*Nyctala acadica*), skin of flammulated screech owl (*Megascops flammeolus*) from Colorado (24851).

RAMBO, M. ELMER (Lower Providence, Pa.). Fossil pentremites from Mt. Newman, Va. 25058.

RAMSAY, Dr. EDWARD P. (See under Australian Museum.)

RAMSBURG, C. A. (Washington, D. C.). Vertebra of fossil whale. 24692.

RANDALL, F. A. (Warren, Pa.). Fossils. Exchange. 25502.

RANSDELL, Master HARRY. (See under Willie B. Tate.)

RATHBUN, Miss M. J. (Smithsonian Institution). Eighty-seven ferns, collected by Mr. Richard Rathbun in Brazil, in 1877. 25404.

RATHBUN, RICHARD (U. S. Fish Commission). Small collection of *Panopeus* from Brazil, collected in 1875-'76. 25381. (See under U. S. Fish Commission, Miss M. J. Rathbun.)

RAY, GARRETT D. (Burnsville, N. C.). Twenty-five specimens of kyanite in quartz, 5 specimens of garnet, 73 specimens of beryl, 8 specimens of columbite, and 1 specimen of samarskite, collected by Mr. W. S. Yeates, U. S. National Museum (exchange) (24917); specimen of prehistoric mica, also collected by Mr. Yeates, from Ray's Mine, Yancey County (24995).

REDDING, E. L. (Organ, N. Mex.). Specimen of muscovite undergoing alteration. 25864.

REGULAR ARMY AND NAVY UNION OF THE U. S. ARMY (Washington, D. C.), through D. C. Brennan, National aide-de-camp. Badge and lapel-button of the Union. 25116.

RETSOF MINING COMPANY (New York City). Sample of lump salt as mined. 24554.

RICE, Mrs. MARIE E. (Coryville, Pa). Flint scraper. 24553.

RICE, Prof. WILLIAM NORTH (Wesleyan University, Middleton, Conn.). Rocks and ores from Connecticut, Massachusetts, and New York. Exchan 25210.

RICH, J. G. (Bethel, Me.). Two varying hares (*Lepus americanus americanus*) in the flesh. Purchase. 25289.

RICHARDS, JOHN T. (See under Forest and Stream Publishing Company.)

RICHARDS, JOSEPH T. (See under Pennsylvania Railroad Company.)

RICHARDSON, W. D. (Fredericksburg, Va.). Thirteen specimens, representing 4 species of coleoptera, specimen of *Adranes cæcus*, 2 specimens of *Batrisus schaumii*, 2 specimens of *Batrisus ionæ*, and 2 specimens of *Batrisus virginiæ*. 25677.

RICHMOND, CHARLES W. (Department of Agriculture, care of U. S. Consul, Greytown, Nicaragua). Three thousand specimens, representing 334 species of birds'

Richmond, Charles W.—Continued.
skins from the District of Columbia, Montana, California and Texas (purchase) (24736); 152 specimens, representing 53 species of reptiles and batrachians from North America (gift) (24745); 31 specimens, representing 3 species of birds' skins (gift) (24773); 3 birds' skins (gift) (25067); long-eared owl (*Asio wilsonianus*) in the flesh from Sandy Spring, Md. (gift) (25100); broad-winged hawk (*Buteo pennsylvanicus*) and sharp-shinned hawk (*Accipiter velox*), in the flesh from Maryland (gift) (25108); marsh hawk (*Circus hudsonius*) (gift) (25165); Cooper's hawk (*Accipiter cooperi*) in the flesh (gift) (25175); long-eared owl (*Asio wilsonianus*) (gift) (25249); red-tailed hawk (*Buteo borealis*) and sparrow hawk (*Falco sparverius*) (gift) (25264); 12 birds in the flesh (gift) (25706); polished hatchet and fragment of stone, probably a pestle, from Costa Rica, insects, 144 specimens of reptiles and batrachians, shells, 32 specimens representing 9 species of crustaceans, alcoholic specimens of *Lepidosteus*, *Heros*, *Eleotris*, *Sciæna*, *Tetragonopterus*, *Xiphorhamphus*, *Tetrodon*, *Querimana*, *Tylosurus*, *Blennius*, *Gobius*, 217 specimens, representing 104 species of birds' skins from San Juan River, Nicaragua, and Rio Trio, Costa Rica, 14 bows and arrows obtained from the Watousa Indians (purchase) (25828).

Ricker, C. B. (New York City). Three hundred and ninety-nine specimens, representing 288 species of birds' skins from the Lower Amazon, chiefly from Santarem and Diamantina. 24681.

Ricketts, L. (See under Department of State.)

Ricksecker, L. E. (Sylvania, Cal.). Two specimens of *Pleocoma Rickseckeri*, one of *Eupompha fissiceps*, and one of *Chalcis ovata*. 24668.

Rider, Ilis I. (Granite Cañon, Wyo.) Specimens of caddis worm (*Limnophilus* sp.). 25779.

Ridgway, Audubon (Brooks' Station, D. C.). Collection of fishes representing about 10 species from Northwest Branch, Md., and Four-Mile Run, Va. 25822.[*]

Ridgway, Robert (Smithsonian Institution). Specimen of pine mouse (*Arvicola pinetorum*) (24562); turkey buzzard juv. (*Cathartes aura*) (24744); 2 birds' skins from Wheatland, Ind., and Laurel, Md. (24766); 29 specimens, representing 17 species of birds' skins from various localities, consisting of selected specimens, each one having a more or less marked peculiarity of plumage (24868); skin of fox sparrow (*Passerella iliaca*) from Laurel, Md. (25688). (See under Master Louis Carmick and E. L. Ormsbee.)

Riley, Prof. C. V. (See under Department of Agriculture, J. M. Aldrich, Prof. L. Bruner, Prof. T. D. A. Cockerell, William J. Fox, Dr. Gustave Michaud, F. J. Niswander.)

Riley, Hon. Owen. (See under James J. Clark.)

Roberts, S. L. (Camden, N. J.). Old-fashioned cast-iron plates, strap-rail and nail, wrought angle splice-bar, Fisher joint with rails and spikes, etc. 25398.

Roberts, W. F. (Washington, D. C.). Bat (*Adelonycteris fuscus*), in the flesh. 24774.

Robertson, W. B. (Saltville, Va.). Gypsum. 24820.

Robinette, Frank (Washington, D. C.). Five specimens, representing 5 species of birds' skins from Chihuahua, Mexico (gift) (24698); nest and 3 eggs of *Myiarchus cinerascens* from San Diego (gift) (24854); 45 specimens, representing 15 species of birds' eggs from the same locality (gift) (24861); 45 specimens, representing 27 species of birds' skins from Mexico (purchase) (24876).

Rockenstyre, C. E. (Albany, N. Y.). Japanese bantam fowl (24696); silky fowl (24701); golden seabright bantam and white polish bantam (25039); buff Pekin bantam fowl (25146).

Rodman, Dr. James (Hickman, Ky.). Bird of Paradise (*Lophorina superba*) from New Guinea. Purchase. 25689.

Rogers, O. P. (Marengo, Ill.). Bog-iron ore. 24658.

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[*] Some of these specimens are remarkably fine and will be reported upon in a paper on District of Columbia fishes.

ROGERS, SYDNEY H. (Washington, D. C.). Original letter written in Georgetown, S. C., to Mrs. Moses Rogers announcing the death of her husband, the captain of the steamship *Savannah*. Deposit. 25674.

ROGERS, THOMAS (Manchester, England), through Wesley and Son. String of beads found in an Indian grave, probably of the Sioux or Cree tribe, from near Saskatchewan River, North-West Territory. 25041.

ROMINGER, Dr. KARL (Ann Arbor, Mich.). One hundred and forty-five Middle Cambrian fossils from Mount Stephen, British Columbia, consisting of *Bathyuriscus howelli* Walcott, *Olenoides nevadensis* Meek, *Ogygopsis klotzi* Rominger. 25325.

ROSENTHAL, JOSEPH (New York City). Four skins of Birds of Paradise. Purchase. 24589.

ROSS, Mrs. GEORGE P. (Clearwater Harbor, Fla.). Shells. 25521.

ROSS, WALDO O. (Massachusetts Institute of Technology, Boston, Mass.). Nineteen specimens, and documents relating to photo-mechanical process work of various kinds. 25745.

ROWAN, JAMES (McKeesport, Pa.). Cup-stone found in the Monongahela River about 2 miles above the mouth of the Youghiogheny. 25884.

ROWE, C. H. (Worcester, Mass.). Nine specimens of *Sciaphilus muricatus* Fab. (25361); 15 specimens of *Oestodes tenuicollis* Rand. (25575, 25835).

ROWLANDS, WALTER (New York City). Six specimens of photographure. 25528.

ROYAL SWEDISH ACADEMY OF SCIENCES (Stockholm, Sweden). One hundred and forty species of Siberian Phanerogams. Exchange. 25227.

ROYAL ZOÖLOGICAL MUSEUM (Florence, Italy), through Prof. Henry H. Giglioli, director. Collection of ethnological objects, chiefly from New Guinea, archæological objects from France, Italy, Egypt, British Honduras, Brazil, and the Andaman Islands; 2 sponges from the Lampedusa River. 24918.

RUSH, Dr. W. H., U. S. Navy (Navy Department). Shells from the eastern coast of South America. 25839.

RUSS, A. B. (Washington, D. C.). Three specimens of native gold in quartz from Potomac gold mine, Maryland. Deposit. 24805.

RUSSELL, CHARLES H. (Bowling Green, Ohio). Bird-shaped object from the Norton farm, north of Center Township, Wood County, Ohio. Deposit. (Returned.) 24625.

RUSSELL, FRANK (Iowa City, Iowa). Six specimens of fossil protozoa and 35 specimens of fossil shale from the drift (25655); 8 fossil shells from Saskatchewan (25617).

RUSSELL, I. C. (U. S. Geological Survey). Collection of Eskimo ivory carvings, dishes, spoons, pipes, daggers, dolls, trinkets, and other objects from the Upper Yukon River, Alaska. 25293. (See under Interior Department. U. S. Geological Survey.)

SADTLER, M. A. (Baltimore, Md.). Specimen of silver ore from Colorado. 24546.

SALTHOUSE, GEORGE. (See under Samuel Alexander Lafone Queredo.)

SAMPSON, F. A. (Sedalia, Mo.). Two specimens of fresh-water sculpin or millersthumb (*Cottus richardsoni* var.) from Spavinaw Creek, Benton County, Ark., (24685); two specimens, representing a new genus and species of blind cave salamander, *Typhlotriton spelæus** (24717).

SANDBERGER, Prof. (See under Titus Ulke.)

SANDHAM, HENRY (Boston, Mass.). Gravure etching proof of the reproduction of the oil painting "Battle of Lexington," the original of which is in the townhall at Lexington, Mass. 25018.

SANFORD, O. N. (San Diego, Cal.). Specimens of *Mitra maura* Swainson from Lower San Diego. 25845.

SARAULT, N. (See under Mrs. B. D. Spenser.)

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*A preliminary description, with figures, of the animal is published in the Proceedings of the National Museum, Vol. XV, pages 115-117, Pl. IX.

SAWYER, Lieut. F. E. (U. S. Navy). Crustaceans collected in Brazil. Purchase. 25340.

SCHAUPP, F. G. (See under Department of Agriculture.)

SCHENCK, CHARLES D. (Washington, D. C.). Thoroughbred pug dog in the flesh. 25872.

SCHENCK, J. (Mount Carmel, Ill.). Barred owl. 25344.

SCHIEFFELIN, S. B. (New York City). Female golden pheasant (*Chrysolophus pictus*) in the flesh. 24806.

SCHMID, EDWARD S. (Washington, D. C.). Iguana (*Metopoceros cornutus*) (24985); strawberry finch in the flesh (24987); African gray parrot (*Psittacus erythacus*) in the flesh (25279); festive parrot (*Amazona festiva*) in the flesh (25302); screech owl (*Megascops asio*) in the flesh (25658); lory (*Electus grandis*) (25678); warbling grass paroquet (*Melosittacus undulatus*) in the flesh (25690); troupial (*Icterus icterus*) in the flesh (25694); 2 specimens of wax-bill weaver-finch (Sporæginthus amandava) in the flesh (25697); 4 specimens of bob-white (*Colinus virginianus*) and a goldfinch (*Carduelis carduelis*) in the flesh (25737); screech owl (*Megascops asio*) in the flesh (25749); Angora cat in the flesh (25871).

SCHOENHOF, CARL (Boston, Mass.). Two books by Kobell, entitled "Die Galvanographie," one published in March, 1872, 4°, 7 plates, the other at Munich in 1876, 4°, 4 plates. Purchase. 24925.

SCHRAUBSTADTER, CARL, jr. (St. Louis, Mo.). Materials used in the photo-mechanical processes. Purchase. 25567.

SCIDMORE, Miss E. R. (Washington, D C.). Three silver bracelets hammered from coins by the Hooniah Indians, Glacier Bay, Alaska; 5 photographs of Indian children and Indians gambling, and a photograph of the Hudson's Bay blockhouse, Nanaimo, British Columbia. 25236.

SCIENCE COLLEGE MUSEUM (Imperial University, Tokio, Japan), through Dr. J. Ijima. Two skins of the Japanese Ptarmigan (*Lagopus*, species undetermined). 24586.

SCLATER, P. L. (See under Zoölogical Society of London.)

SCOVILLE, J. T., and Mr. **WOOLMAN** (Terre Haute, Ind.). Small collection of fishes from Mexico, consisting of *Leptops olivaris*, *Ictalurus punctatus*, *Codoma ornata*, *Campostoma ornatum*, *Notropis chihuahua*, *Cyprinodon gibbosus*, *Gambusia patruelis*, *Etheostoma scovelli* n. sp., *Etheostoma micropterus* and *Atherinops*, also small collection of reptiles from Mexico. 25859.

SCUDDER, N. P. (U. S. National Museum). Three snakes from Maryland, including a specimen of *Ophibolus rhombomaculatus* (24913); 11 garter-snakes from Eckington, D. C. (25573).

SCULL, Miss **SARAH** (Washington, D. C.). Scarf made in a native hand-loom in Greece. Returned. 25153.

SEALE, WILLIAM P. (U. S. Fish Commission). Three specimens of American pipit (*Anthus pensilvanicus*) in the flesh from Alexandria, Va. 25695.

SEBERT, W. F. (Brooklyn, N. Y.). Two specimens of *Ostrea virginica*, one containing a pearl. 25171.

SEER, A. S. (Theatrical Printing Company, New York City). Two specimens of poster work in colors. 25586.

SEIBERT, S. R. (Washington, D. C.). Daguerreotype of "Clark Brothers" taken in 1854, and a daguerreotype landscape of Fort Snelling taken in 1857. 25603.

SEIDLER, CHARLES. (See under A. C. Carlyle.)

SEIFERT, W. (Lancaster, Pa.), through F. C. Neeb. Polished stone object of the boat-shaped class made of banded slate. 25343.

SELBY, WILLIE (Twining City, D. C.). Small rude implement and 33 arrow-heads. 25144.

SEWALL, Hon. **HAROLD** M. (Consul-General, Apia, Samoa). Collection of Samoan musical instruments, consisting of a long bamboo and mat, native name "Tui

SEWALL, Hon. HAROLD M.—Continued.
Tui," 2 flutes, native name "Fagufagu," Pan's pipe used by black "labor boys," from Solomon Island, native name "Faaili," 3 reed pipes, native name "Faai," conch-shell trumpet, native name "Pu," and a wooden drum, native name "Paté." 24721. *

SHELTON, J. C. (Roseland, Va.). Eighty-one specimens of apatite and menaccanite, 3 specimens of massive rutile, 5 specimens of apatite and rutile, one specimen of apatite, and 3 specimens of rutile, collected by Mr. W. S. Yeates, of the National Museum (24712, 24747).

SHEPARD, JAMES H. (Brookings, S. Dak.). Fossil resin from an artesian well, James River Valley, near Melette. 24759.

SHERIDAN, EDMUND J. (Brooklyn, N. Y.). Triangular-shaped stone found on the beach near Coney Island. 24758.

SHARPLESS, H. P. (Boston, Mass.). Two specimens of columbite from Wakefield, N. H. 24543.

SHAW, E. M. (Cook, Nebr.). Two alcoholic specimens of Say's king-snake (*Ophibolus sayi*). 24826.

SHAW, JAMES C. (Tekamah, Nebr.). Indian axe from Connecticut. 24718.

SHAW, N. C. (Shane, Md.). Carved peachstone. 24852.

SHUFELDT, PERCY W. (Takoma Park, D. C.). Female summer tanager (*Piranga rubra*) in red plumage. 24587.

SHUFELDT, Dr. R. W., U. S. Army (Takoma Park, D. C.). Specimen of *Carinifex newberryi* from Equus Beds, Fossil Lake, Oregon (24536); iguana, *Melopoceros cornutus* (24691); model of a fossil bird, *Archæopteryx macrura* from Solenhofen, Bavaria (24764); skin of Wilson's snipe (*Gallinago delicata*) from Fort Wingate, N. Mex. (25765); birds' skins and nests (25865).

SHUFELDT, R. W., jr. (Takoma Park, D. C.). Six specimens, representing 5 species of birds' skins from Takoma Park, D. C., and Fort Wingate, N. Mex. 24620.

SHUMAKER, P. F. (Flat Creek, La.). Rock. 25797.

SIGUA IRON COMPANY (Santiago de Cuba, Cuba), through John Vallance, superintendent. Sigua ores. 25803.

SIMPSON, A. M. (Straubville, N. Dak.). Two specimens of gypsum. 24646.

SIMPSON, CHARLES T., and J. C. Henderson jr. (Washington, D. C.). Specimens of fishes, representing 11 species, consisting of *Ostracion*, *Siphostoma*, *Aphoristia*, *Hippocampus*, *Batrachus*, *Gobius*, *Prionotus*, *Echeneis*, *Branchiostoma*; snake, crustaceans, shells, and mollusks. 25300.

SIMPSON, CHARLES T. (U. S. National Museum). Dried specimens of *Lepas hillii* from New Zealand. 25455.

SINGLEY, J. H. (Austin, Tex.). Valve of *Cytherea texasiana* Dall and a specimen of *Donax Roemeri* Phil. 25418.

SMILLIE, JAMES D. (New York City). Aquatint plate wet ground, showing different degrees of granulation. 25082.

SMITH, E. KIRBY (Jaltipam, Vera Cruz, Mexico). Four beetles. 24775.

SMITH, HARLAN I. (East Saginaw, Mich.). Portion of the head of a fish, with vegetable fungus, *Saprolegina*, attached. 25606.

SMITH, Dr. HUGH M. (U. S. Fish Commission). Frog from Grenadier Island, N. Y. (25196); set of human ear-bones (25228); five mud puppies (*Necturus lateralis*) (25230); series of eight human hyoid bones (*Homosapiens*) (25251); 7 specimens of *Acris gryllus* from Plymouth, N. C. (25857).

SMITH, H. P. (Adams Mill, Ohio). Thirty-four arrow-heads and 2 scrapers. 24732.

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* Purchased for the National Museum at the request of the Secretary of the Smithsonian Institution.

SMITH, JAMES P., & Co. (New York City).
SMITH, R. H. KIRBY (Sewanee, Tenn.). Eg
atus, Geotrygon montana and *Crotophapa*
SMITH, U. C. (Philadelphia, Pa.). Specime
Anglesea, N. J. 25237.
SMITH, WILLIAM G. (Loveland, Colo.). Ne
difficilis and *Poocætes gramineus confi*
(*Spermophilus 13-lineatus*) and pouched
(purchase) (25818); through Captain
little flycatcher (*Empidonax pusillus*) fr
SMITHSONIAN INSTITUTION.
U. S. Bureau of Ethnology, under directio
W. Powell, director.
Through Maj. Powell: Collection of
made by Dr. W. J. Hoffman in M
and '90, relating to the ritual of the
the "Grand Medicine Society" (249
consisting of 142 specimens of bead
lar objects, obtained from a mound
(25306); 370 ethnological objects c
Kiowa Indians, Oklahoma Territo
nology, and transferred to the Nati
U. S. National Museum, under direction
Brown Goode, assistant secretary.
Collected by Dr. G. Brown Goode:
(25355);* eight lamps, counters for
wedges, distaff with photograph
hazel-nuts, photograph of a statute
offerings, playing-cards, and vari
ethnological objects, ceremonial
consisting of an ocarina, bone flut
di ottone (clarionet of brass), zam
doline), salterio (dulcimer) from F
lion of Lucca della Robbra ware, c
Collected by Messrs. W. H. and A. H
species from Angola, Africa (25702)
Collected by Mr. Romoyn Hitchcock
China; specimens illustrating the p
bearing galena from Monarch Min
lumbia (25499).
Collected by Mr. P. L. Jouy: Elev
birds' skins and a mud-turtle from
ing 6 species of birds' skins from t
from Sonora, Mexico, 2 from Tuc
a Mexican deer, and 3 mammal sku
of fishes from the same locality,
nigrescens, Cyprinus carpio, Cyprino
donts (24585); skin of barn owl
(24643); crustaceans, echini, wor
(24645); collection of fishes from

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* The potteries have been discontinued
mostly of the fourteenth and fifteenth ce
highly ornate character, used by druggists

† Purchased by Dr. Goode for the Nation

SMITHSONIAN INSTITUTION—Continued.

Larval probably from *Clupeoid*, *Etropus crossotus*, and *Tetrodon politus;* 4 mice from Guaymas, and a common mouse and field mouse from Tucson, fresh-water shells (*Planorbis*) from the latter locality, and marine shells and mollusks from Guaymas, Mexico; 12 specimens of coleoptera and other insects from Tucson and Nogales, Ariz., ground-dove (*Chamepelia passerina* (24686); mammal skins and skulls; 55 specimens, representing 33 species of birds' skins, and 4 specimens of *Sceloporus minor* (splendid specimens and new to the collection) from Mexico (25257); specimens of fresh-water crabs and crayfishes from Lake Chapada, Jalisco, Mexico (25444).

Collected by Mr. George P. Merrill: Two large blocks of stalagmite marble from near Marion, Washington County, Va. (24729); zinc ores from Bertha zinc mines, near Marion, and specimens of colored marbles from the same locality (24734); specimen of blue pyroxene with secondary serpentine from the Middle Gila, Grant County, N. Mex., and geological material from Yavapai County, Ariz. (25198); 9 specimens of geological material from Arizona (25199); specimens of coal from Gallup, N. Mex., andesite and basalt from Flagstaff, Ariz., and sandstone and other material from Cañon Diablo, Ariz. (25226); specimens of *Asida sordida* Lec-lex, the only insect found on the plains about Cañon Diablo, Ariz. (25247); metates and mullers from abandoned cave-dwellings near Flagstaff (25250); ores and general geological material from Silver City, N. Mex., and vicinity (25290); rocks from Organ Mountains, N. Mex., and ores from Bennett Mine, near Las Cruces, N. Mex. (25385).

Collected by Mr. W. H. Newhall. Syenite rocks (24903); zinc ores and kersantite from New Jersey (24912); conglomerate breccia from Loudoun County, Va. (25002).

Collected by Mr. W. S. Yeates. Minerals consisting of transparent oligoclase, garnet, hydromagnesite, tremolite, actinolite, and magnesite (24715); 3 specimens of nickeliferous talc from Jackson County, N. C. (24993); 9 Miocene fossils from Murfreesboro, N. C., consisting of 5 specimens of *Cardita granulata* and *Astorte* (25713).

National Zoölogical Park, under the direction of the Smithsonian Institution.

Through Dr. Frank Baker, acting manager: Three specimens of scarlet ibis and one of curassow (24829); Arctic fox from St. George's Island, Alaska, collected by Dr. C. Hart Merriam, and an agouti one day old (24879); specimen of Carolina paroquet (*Conurus carolinensis*) in the flesh (24920); spider, *Eurypelma* sp. (25013); anaconda (*Eunectes murinus*); 3 specimens of lizards, *Tupinambis nigropunctatus*, and a hawk, *Buteo borealis* (25038); *Jacare nigra* (25049); Duncan Island tortoise (*Testudo ephippium* (?) collected by Mr. C. H. Townsend (25063); armadillo (*Tatusia novemcincta*) from San Diego, Tex., badger (*Taxidea americana*) from Collyer, Kans., muskrat (*Fiber zibethicus*), and a moose (*Alces machlis*) from Byng Inlet, Me. (25126); civet from Waldo County, Tex.; deer, *Cariacus* sp., from Selma, Ala.; cat, *Felis;* mink, *Putorius vison*, from the District of Columbia, and a monkey, *Cebus* (?) *apella* (25128); ocelot (*Felis pardalis*) (25129); 2 specimens of lynx, *Lynx maculatus* from Waldo County, Tex. (25131); deer, *Coassus nemarivagus*, from Trinidad, West Indies (25134); prong-horned antelope (*Antilocapra*) from Galatea, Colo., and a badger, *Taxidea americana*, from Wyoming (25135); opossum, *Didelphys marsupalis:* armadillo, *Tatusia novemcincta ;* deer, *Cariacus* sp.; marmoset, *Hapale* sp.; bridled weasel, *Putorius brasiliensis* (25136); armadillo, *Tatusia novemcincta*, collected by Mr. R. T. Hill, and an ant-bear (*Myrmecophaga jubata*) purchased from Mrs. E. Conklin (25138); armadillo, *Tatusia* sp., from Carácas, Venezuela, collected by Mr. R. M. Bartleman (25141); badger, *Taxidea americana*, and a peccary (*Dicotyles tajacu*) (25209); tortoise (*Testudo tabulata*)

SMITHSONIAN INSTITUTION—Continued.
(25229); male and female specimens of Virginia deer (25275); specimen of cayman (juv.) from Trinidad, West Indies, collected by Ensign Roger Wells, jr., U. S. N. (25371); specimen of kinjajou, *Cercoleptes condivolvulcus*, in the flesh from Mexico (25416); American barn owl (*Strix pratincola*) from Albany, Tex. (25692); American barn owl (*Strix pratincola*) in the flesh (25693); white-winged dove (*Melopelia leucopetera*) and a specimen of least bittern (*Ardetta exilis*) in flesh (25696); red fox and 4 Angora goats (25810); bronze turkey of the domestic variety (25870).

Through A. B. Baker. Skin of skunk, *Mephitis*, from Nebraska, skin of black-footed ferret, *Putorius nigripes*, and skin of little striped skunk, *Spilogale*, from Trego County, Kans. (24693); skin of shrew (*Blarina*) (24978).

SNYDER, JACOB (Two Taverns, Pa.), through Prof. F. W. Clarke. Specimen of meteoric iron from Mount Joy. 24750.

SNYDER, THEO. (Brooklyn, N. Y.). Five proofs of photo-mechanical relief work. 25747.

SNYDER, W. E. (Beaver Dam, Wis.). Twenty-four specimens of coleoptera. 25781.

SOCIÉTÉ ANONYME DE MARCINELLE COUILLET (Couillet, Belgium). Bronze model of Z tie and rail-fastening belonging to the Willemin System. 25424.

SOMERS, Dr. J. F. (Crisfield, Md.). Slug found in a brick cistern. 24942.

SOUTHWICK AND CRITCHLEY (Providence, R. I.). Skin of badger, *Taxidea americana*, and a mounted specimen of Canada lynx (*Lynx rufus*) from Connecticut (24662); 4 specimens, representing 3 species of birds' skins from Florida (24916).

SPENSER, Mrs. B. D. (Brooklyn, N. Y.), through Dr. H. T. Cresson, Pyrula shell with an engraving of Mastodon, human and animal teeth, shells, beads, bone implements, stone arrow and spear-heads, perforators and scrapers, and a piece of wood showing the cutting marks of a stone axe, discovered by Dr. Cresson and Mr. N. Sarault in 1864, from the peat and fallen forest layer near Holly Creek, Del., and forwarded to the Museum by Prof. F. W. Putnam, of Peabody Museum, 24695.

SPICER, Capt. JOHN O. (Groton, Conn.). Four pairs of Eskimo trousers from Hudson's Bay. Deposit. 24[illegible]83.

SPIBDLE, H. H. (Warrenton, Va.). Specimen of oölitic magnetite. 25030.

SPRINKEL, J. W. (Dulinsville, Va.), Specimen of the caterpillar of Geometrid-moth (*Chœrodes* sp.). 25760.

SQUYER, HOMER (Mingusville, Mont.). Twenty specimens of cretaceous fossils. Exchange. 25557.

STABLER, HOWARD (Sandy Spring, Md.). Hawk, red-tailed hawk (*Buteo borealis*), red-shouldered hawk (*Buteo lineatus*); 2 specimens of screech owl (*Megascops asio*) (24971, 25216, 25301); 3 specimens of blue jay (*Cyanocitta cristata*) in the flesh (25391, 25410, 25483).

STABLER, JAMES P. (Sandy Spring, Md.). Red-tailed hawk (*Buteo borealis*) in the flesh (25120); barred owl (25634).

STANDARD HUB COMPANY (Philadelphia, Pa.). Hub-block seasoned by pressure. 25423.

STANLEY, H. M. (Nogales, Ariz.), through Mr. P. L. Jouy. Four specimens of arachnida, wasp, and a grasshopper from Mexico 24595.

STANTON, T. W. (See under Interior Department. U. S. Geological Survey.)

STARKWEATHER, Mrs. H. R. (Waldrip, Tex.). Specimen of hawk-moth (*Philampelus linnei* G. & R.). 24839.

STATE DEPARTMENT, through Hon. James G. Blaine, Secretary of State. Sprigs of *Selaginella*, a "feathery seed," and four butterflies, collected in Central Africa by Mr. J. H. Camp (25601).

Through Mr. Sevellon A. Brown, chief clerk. Specimens of Indian we
yarns and fabrics, transmitted to the Department of State thro

State Department—Continued.

General Samuel Merrill, Calcutta (24904); fabrics of wool from Chittaldroog and Davengire Taluks, in the Chittaldroog district, Mysore Province, contributed by Mr. L. Ricketts, director of statistics and agriculture in Mysore Bungalore (24905); samples of wool and woolen fabrics from the same locality, collected by Mr. L. Ricketts, and transmitted by Consul-General Merrill (25315); samples of Indian wool collected by Consul-General Merrill, and a report on sheep and wool in India written by him (25316). (See under Calcutta Botanic Garden, Dr. J. F. Chittenden and R. W. Turner.)

Stearns, Frederick (Detroit, Mich.). Six specimens of *Hydractinia* (exchange), and 8 specimens of *Helix quesita* Deshayes (gift) from Japan (24617); 6 specimens of *Achatina panthera* from Mauritius (exchange) (24960); shell-sand and specimens of *Meritina granulosa* from Honolulu, Sandwich Islands (gift) (25836).

Stearns, Dr. R. E. C. (U. S. Geological Survey). Recent and fossil shells from California, singularly distorted specimens of *Olira* from the Gulf of California, and tooth of a fossil shark from San Diego (24841); 4 specimens of shrimp from the west coast of North America, and a garter-snake from Berkeley, Cal. (25507); daguerreotype portrait made in 1856, 2 ambrotype portraits made in 1859, daguerreotype view of a church made in 1857, and 3 ambrotype landscapes made in 1862 (25604). (See under Philip Albert.)

Stein, L. C. (Milwaukee, Wis.). Nine albumen prints, consisting of "Harvesters," "Return," "Aunt Tilley's Story," "Tobogganing," "Who Comes," "Rest," "Here's Looking at You," "Dancing Girl," "Maud Muller," and "Nary a Bite." 25318.

Steiner, Dr. R. (Waynesboro, Ga.). Two rude implements and a spear-head. 25321.

Stejneger, Dr. L. (U. S. National Museum). Skin of short-tailed shrew (*Blarina brevicauda*) (24561); 40 specimens, representing 16 species of birds' skins from various localities, including a series of 18 specimens of *Sitta cæsia* (24867).

Stephenson, A. (Cincinnati, Ohio). Indian arrow-head from San Miguel Island, opposite Santa Barbara, Cal. 25720.

Steuart, Charles A. (U. S. National Museum). Specimen of *Manilla texana*. 24703.

Stevenson, Mrs. M. E. (U. S. Bureau of Ethnology). Two fetiches (bear) from N. Mex. (24622); 4 feather plumes and a stone object obtained from the Zuñi Indians of New Mexico. Deposit. (25580).

Storment, Edgar L. (Tempe, Ariz.). Three toads, 3 lizards, *Rufo woodhousei, Cnemidophorus* sp., *Uta stansburiana* and *Callisaurus dracontoides*, 2 bats, *Molossus californicus* and *Atalapha cinerea* (25101); specimen of *Heloderma suspectum* (25581). Exchange.

Streng, Prof. A. (Giessen, Germany). Twenty-six minerals, including chabazite, phillipsite, barite, beauxite, tridymite, phacolite, faujasite, strengite, cacoxenite, cleanorite and gismondite. Exchange. 25789.

Strother, W. A. (Lynchburg, Va.). Artificial stalagmite. 25800.

Sugden, Miss E. (Haysville, Pa.). Specimen of luna-moth (*Actias luna* L.). 25824.

Surber, T. (White Sulphur Springs, W. Va.). Eggs of *Turdus mustelinus, Merula migratoria, Tyrannus tyrannus, Harporhynchus rufus, Galeoscoptes carolinensis, Corrus americanus, Sterna antillarum, Turdus ustulatus, Troglodytes ædon parkmanii, Carpodacus frontalis rhodocolpus, Pipilo alberti, Quiscalus quiscula æneus;* a discoidal stone from Parkersburg, stone axe, and 5 arrow-heads. 24701.

Sutherland, John (New York City). Squirrel-fish (*Serranus fascicularis*). 25305.

Tabler, J. H. (Seabrook, Md.). Opossum, *Didelphys marsupialio*. 25608.

Takayanagi, T. (New York City.) Seventeen pieces of pottery, consisting of Satsuma faience, Raku ware, Takatori ware, Bizen ware, Bank faience, Kioto ware, Imari and Tokio porcelain. Purchase. 25060.

Tate, Master Willie B., and Harry Ransdell (Washington, D. C.). Fragment of a species of *Streptorhynchus* from West Virginia. 24935.

TAYLOR, DOUGLAS (Center Market, Washington, D. C.). Specimen of spiny swellfish, *Chilomycterus geometricus*. 25770.

TAYLOR, Rev. G. W. (Victoria, British Columbia). Shells and slugs from Vancouver Island. 25033.

TAYLOR, MARY M. (See under General M. C. Meigs.)

TEPPER, J. G. O. (See under Department of Agriculture.)

TEST, FREDERICK C. (U. S. National Museum). Thirty specimens, representing 6 species of reptiles and batrachians, chiefly from Indiana (24844); 36 salamanders (25753).

THAYER, A. H. (Scarboro, N. Y.). Specimen of hog-nose snake. 25020.

THE CROWN TYPEWRITER COMPANY (Brooklyn, N. Y.). "Crown" typewriter. Deposit. 25588.

THE E. S. GREELEY COMPANY (New York City), through Mr. G. C. Maynard. Morse-register, sounder, relay and key, bottle of ink and 2 rolls of paper used in 1891, belonging to the Old Time Telegraphers' Collection. Deposit. 25412.

THE GOLDING & SONS COMPANY (Hockessin, Del.). Feldspar and clay used in the manufacture of pottery. 24720.

THE SINGER MANUFACTURING COMPANY (New York City). Old style Singer sewing machine mounted on an iron stand, and a machine of the latest improved make mounted on an oak stand. 24666.

THOMAS, FREDERICK L. (Ashton, Md.). Blue jay (*Cyanocitta cristata*). 25490.

THOMAS, WILLIAM S. (Washington, D. C.). Four hundred and thirty-four archæological specimens, consisting of Indian stone relics, fragments of pottery and other objects from Blagden's Hill, D. C. Deposit. 25675.

THOMSON, JOHN H. (New Bedford, Mass.). Stone implement (?) found on the Fair Haven side of the Acushnet River. Deposit. 24965.

THOMPSON, EDWARD S. (Thompsontown, Pa.) Four hundred and eight archæological objects, consisting of Indian relics, arrow-heads, perforators, rude chipped implements, chipped disc, notched sinkers, polished hatchet, fragments of steatite vessels, fragments of pottery, pieces of clay and fossil shells, found along the shore of the Juniata River. between Thompsontown and Port Royal. 25117.

THOMPSON, H. P. (Belfast Me.), through the U. S. Fish Commission. Specimen of *Argentina silus*. 24684.

THOMPSON, JOHN (Oakland, Cal.). Two specimens of mourning-cloak butterfly (*Vanessa antiopa* L.). 24634.

THWAITES, GEORGE H. (Socorro, N. Mex.). Three fine specimens of Lepidodendron. 25393.

TIBBEY, B. (Butte, Mont.). Thirteen specimens of a mixture of bornite, chalcocite, and pyrite. 25029.

TIFFANY & COMPANY (New York City). Three specimens of ornamental stone, consisting of jasper, rhodonite, and rock crystal from Asiatic Russia, and a specimen of "phantom" quartz from Brazil. 25419. Exchange.

TIPHAINE, V. L. (Lewiston, N. Y.), through Forest and Stream Publishing Company. Large specimen of bowfin (*Amia calva*). 25788.

TOLLIN, OSCAR (Sarasota, Fla.). Five specimens of earth star (*Geaster fornicatus* Huds.) (25436); mussel from between the lakes of Miakka (25832).

TOMS, Capt. M. C. (Hendersonville, N. C.). Twelve specimens of zircon crystals from the Jones Zircon Mine, Henderson County, and 4 of xanthitane crystals from the same locality, collected by Mr. W. S. Yeates, of the U. S. National Museum. 24742.

TORNQUIST, LEON (Lund, Sweden). Graptolites. Exchange. 24609.

TOWNLEY, N. M., jr. (Sayreville, N. J.). Two fossil specimens found 40 feet under the bank of the Raritan River, New Jersey. 25811.

TOWNSEND, CHARLES H. (Steamer *Albatross*, San Francisco, Cal.). Fiv Steller's sea-lion (*Eumetopias stelleri*), and 2 specimens of Harbor seal

TOWNSEND, CHARLES H.—Continued.
tulina), collected near Monterey, Cal. 25503. (See under U. S. Fish Commission, Smithsonian Institution. National Zoölogical Park.)

TOWNSEND, TYLER (Las Cruces, N. Mex.). Type specimens representing 16 species of *Muscidæ, Thrincopyge alacris, Macrobasis, Gissleri*, and *Oiketicus* sp., with cocoons. 25792.

TRAILL, W. E. (Stuart's Lake, British Columbia). Mammal skins and skulls, and birds' skins. 24705.

TREASURY DEPARTMENT.

U. S. Coast and Geodetic Survey, through T. C. Mendenhall, superintendent: Alcoholic specimens of insects, 2 dragonflies, butterflies, beetles, 9 filter-papers specimen of the sediment of Yukon River taken each month from September, 1890, to May, 1891; alcoholic frog from Camp Davidson, Yukon River, Alaska; 4 birds' eggs, nest and egg; specimen of *Anoplarchus atropurpureus*; 13 specimens, representing 13 species of birds' skins; 2 skins of flying-squirrels, alcoholic specimen of mouse, and specimens of fœtus of mammals, collected by Assistant J. E. McGrath during his boundary expedition to Alaska (25431).

U. S. Life-Saving Service. Rare specimen of fossil crab, transmitted by Capt. J. J. Dunton, Keeper of Life-Saving Station, Ocean City, Md.; also quartz pebbles and 2 sea-horses (*Hippocampus hudsonius*) (25640); skeleton of *Physeter macrocephalus* juv., from Green Run Inlet Life-Saving Station, collected by Capt. Dunton (25346).

U. S. Revenue Marine Service. Capt. M. A. Healy, Steamer *Bear*, San Francisco, Cal., transmitted, through Lieut. D. H. Jarvis, the skin of a female walrus, *Odobænus obesus*, captured in Holy Cross Bay, Siberia (25474).

TRISTRAM, Rev. H. B. (The College, Durham, Eng.). Fifty-three specimens, representing 47 species of birds' skins from New Guinea, New Caledonia, New Hebrides and Fiji Islands. Exchange. 25307.

TRUE, Dr. A. CHARLES (Department of Agriculture). Six cretaceous fossils from Union Town, Ala.; teeth of *Corax pristodontus, Lamna elegans*, and *L. cuspidata*, and vertebra of *Lestosaurus*, 25642.

TUCKER, Mrs. M. (Ortonville, Mich.). Fourteen fossil corals from the drift. 25607.

TURNER, H. W. (U. S. Geological Survey). Alcoholic specimen of shrew (*Sorex vagrans*). 24812. (See under Interior Department. U. S. Geological Survey.)

TURNER, J. H. Costumes, boat, models, tools, ivory carvings, and other ethnological objects. Deposit. 25562.

TURNER, MATHEW (San Francisco, Cal.). Photograph of the *Jessie*. 25032.

TURNER, Hon. R. W. (U. S. Consul, Cadiz, Spain), through Department of State. Small cast of a Phœnician tomb from Cadiz (purchase) (24786); old door from the convent of La Rabida at Palos, Spain (gift) (25681).

TURPE, ALBERT (Brackettsville, Tex.). Fresh-water sponge from Pinto Creek, Kinney County. 24710.

TURTON, Capt. W. H. (Royal Engineers, Brompton Barracks, Chatham, England). Collection of shells from St. Helena, comprising over 400 species. 25501.

TYSON, JAMES W. (Baltimore, Md.). Magnetite, consisting of native gold from the Mineral Hill mine, Carroll County. 25648.

ULKE, HENRY (Washington, D. C.). Twenty-six specimens, representing 8 rare species of coleoptera, collected at Blue Ridge Summit, Franklin County, Pa., (new to the collection) (24888); 168 specimens, representing 19 species of North American coleoptera (25112).

ULKE, S. (Washington, D. C.). Twelve land-shells from Hill City, South Dakota. 25403.

ULKE, TITUS (Pueblo, Colo.). Snake, *Storeria occipitomaculata*, from Hill City, South Dakota (25115); chlorite pseudomorph after feldspar, presented to Mr. Ulke by Prof. Sandberger, and wulfenite from the Richmond mine, Black Hills, South Dakota (25374).

UNWIN, F. S. (See under Dr. Julius Neumann.)

VAN DEMAN, H. E. (Department of Agriculture). Specimen of black skimmer (*Rhynchops nigra*). 25754.

VADEN, L., & COMPANY (Washington, D. C.), through M. D. Knight. Two rude soapstone bowls found while excavating on Connecticut avenue extended. 25764.

VAIL, BENJAMIN (Washington, D. C.). Trilobite from three miles west of Aurora, Ind. 25496.

VAIL, Judge STEPHEN. (See under Mrs. John H. Lidgerwood.)

VALLANCE, JOHN. (See under Sigua Iron Company.)

VARCE, CLARENCE and SAMUEL E. (Brownsville, Ala.). Living specimen of alder-blight, *Pemphigus tesselatus* Fitch. 25037.

VASEY, Dr. GEORGE. (See under Department of Agriculture.)

VELIE, Dr. J. W. (Chicago, Ill.). Twenty-eight fresh-water shells from Minnesota. 24961.

VAUGHAN, T. WAYLAND (Mount Lebanon, La.). Seventy-five specimens, representing 11 species of fresh-water shells from Louisiana (24848); 5 specimens of *Unio cuneus* Cone (25102); specimens representing 3 species of Unio (25160); 23 species of Eocene fossils (25473).

VERRILL, Prof. A. E. (See under Peabody Museum.)

VON STREERUWITZ, W. (State Geological Survey, Houston, Tex.). Two specimens of silver copper ores from Hazel Mine, El Paso County (gift) (24725); ores and rocks from Texas (exchange) (25059); rocks and building-stone (gift) (25206); rocks and ores from Texas; black mica and fossil wood (gift) (25482).

VOTH, Rev. T. R. (Darlington, Okla.). Tomahawk pipe. Purchase. 25145.

WAGNER FREE INSTITUTE OF SCIENCE (Philadelphia, Pa.). Twenty-seven species of land-shells from Jamaica, West Indies (24694); through Mr. Joseph Willcox, collection of Pliocene fossils from the Waccamaw River, South Carolina (25522).

WALCOTT, C. D. (U. S. Geological Survey). Four specimens of calcite from Smith's Basin, Washington County, N. Y. (25191); contorted slate from near Wells, Rutland County, Vt. (25207); 5 echinoids, 5 specimens of flint and the tooth of a shark from the cretaceous chalk of Croydon, England (25218). (See under Interior Department. U. S. Geological Survey.)

WALKER, ERNEST (New Albany, Ind.). Plants from Kentucky and Indiana. 24673.

WALLACE, Mrs. CATHARINE (Melbourne, Australia). Fungus growth from New Zealand, representing the genus *Torrubia*. 25599.

WALLACE, W. O. (Wabash, Ind.), through Dr. O. P. Hay. Snake, *Tropodonotus leberis*. 25656.

WALLINGSFORD, W. W. (U. S. National Museum). Two horse-chestnuts used as a charm against rheumatism. 24828.

WARD'S NATURAL SCIENCE ESTABLISHMENT (Rochester, N. Y.). Fruit-bat (*Pteropus lanigera*) (type specimen) from the Samoan Islands (purchase) (24559); 6 alcoholic specimens of bats (purchase) (24566); mounted and unmounted mammal skins, including a moose, 2 specimens of wapiti, 3 mounted alpacas, a llama and others (purchase) (24574); 15 skins and 8 mounted mammals consisting of *Felis colocolo* (?), *Lama paca* juv., *Lama glama*, *Lama vicugna*, *Chlamydophorus truncatus*, *Putorious vison* (mounted), *Felis concolor*, *Alces machlis*, *Cervus canadensis* juv., *Bison americanus*, *Cebus capucinus*, *Cebus variegatus*, *Lutra felina*, *Procyon caucrivorus*, *Capromys pilorides*, *Tatusia pēba*, *Lutra brasiliensis*, *Hapale rosalia*, *Mephitis mephitica*, *Pithecia nocturna* (skins) (purchase) (24650); specimens of fluorite, siderite after fluorite, barite, aragonite, opal, native mercury, and krönkite (exchange) (24762); specimens of calcite, pyromorphite, torbernite, hematite, orthoclase, realgar, orpiment rhodochrosite, columbite, fluorite, sodalite, eudialite and prehnite (purchase) (24778); specimens for the synoptic series of invertebrates (purchase) (24983); series of models of nervous, circulatory, and digestive systems of various invertebrates and vertebrates (purchase) (25052); 4 skins of moles and 6 of shrews (purchase) (25133).

WARD, Prof. LESTER F. (See under Interior Department. U. S. Geological Survey.)

WARNER, AMBROSE (Washington, D. C.). Stone axe found near Bladensburg, Md. Deposit. 24833.

WARNER, WILLIAM (Salem, Oregon). Two skins of dusky screech owl (*Megascops asio saturatus*). 25699.

WARNER, WILLIAM J. (Salem, Oregon). Skin of jumping-mouse (*Zapus hudsonius*). 25614.

WARNER, W. S. (See under Florida Phosphate Company.)

WARREN, Dr. B. H. (West Chester, Pa.). Bats, and 4 skins of bats. 25394.

WARREN, EWEN, jr., & COMPANY (Chicago, Ill.). Four architectural drawings, printed by the company's multi-color process. 25073.

WATERS, Z. D. (Baltimore, Md.). Collection of Japanese costumes and objects of industry and worship. Purchase. 25804.

WATTS, BLAKE, BEARNE & COMPANY (Newton Abbe, Devonshire, England), through Mr. R. N. Worth. Pipe, pottery, and earthenware clay, and samples of molding-sand. 25527.

WAYMAN, G. TURNER (Port-of-Spain, Trinidad, West Indies). About 1050 specimens, representing 90 species of butterflies. Purchase. 25335. (See under Wells, jr., U. S. N.)

WAYNE, ARTHUR C. (Old Town, Fla.). Skins of swallow-tailed kite (*Elanoides forficatus*) from Florida. 25829.

WEAVER & IHL (New York City, N. Y.). Specimen of winter flounder (*Pseudopleuronectes americanus*) from the coast of New England. 25389.

WEBB, Hon. ALEXANDER R. (U. S. Consul, Manila, Philippine Islands). Two packs of playing-cards, 2 rattan globes or balls used by natives (gift) (24782); 7 spoons and paddles used by natives, Bolo or handy knife (native), 9 games, puzzle, 12 bamboo musical instruments (25806).*

WEBB, DEWITT (St. Augustine, Fla.). Three hundred and thirty-nine archæological objects, consisting of shell implements, fragments of pottery, bone implements, human bones, bones of fishes, animals and birds from shell-mounds near St. Augustine. 25232.

WEBB, Judge JOHN G. (Osprey, Fla.). Four star-fishes. 25568.

WEBB, J. S. (Disputanta, Va.). Molar tooth of a mastodon. 25629.

WEBB, WALTER F. (Geneva, N. Y.). Sets of eggs of *Symphemia semipalmata inornata*, *Zonotrichia leucophreys*, *Zonotrichia coronata*, *Amphispiza belli nevadensis*, from California and Nevada (gift) (24990); 5 sets of eggs of *Larus californicus* from Pyramid Lake, Nevada (gift) (25036); 8 eggs of bridled tern (*Sterna anæthetus*), and 4 eggs of white-crowned pigeon (*Columba leucocephala*) from Atwood's and Acklin's Islands, Bahamas (purchase) (25166); 109 specimens of birds' eggs, representing 12 species, and 30 sets of eggs, consisting of *Empidonax acadicus*, *Cistothorus palustris*, *Piranga erythromelas*, *Icteria virens*, *Mimus polyglottos*, *Ægialitis wilsonia*, *Helinaia swainsonii*, *Passerina ciris*, *Guiraca cærulea*, *Icterus spurius*, *Sterna antillarum*, and *Quiscalus major*; also ten nests (gift) (25323).

WEBSTER, GEORGE W. (Lake Helen, Fla.). Land and fresh-water shells from Florida, Michigan and Tennessee. 24626.

WEED, WALTER H. (See under Interior Department. U. S. Geological Survey.)

WEEDON, W. C. (See under Smithsonian Institution. National Zoölogical Park.)

WEEMS, DAVID G. (Baltimore, Md.). Photograph and cyanotype of electric-motor car (25186); electric motor that made the fastest authentic speed on land "by generated power," and 2 photographs of the same, accompanied by a certificate of the speed of the motor (25856).

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* These objects were purchased by Mr. Webb for the National Museum at the request of the Secretary of the Smithsonian Institution.

Weil Brothers (Alexandria, Va.). Spanish

Wellington, A. M. (See under Engineering

Wells, Ensign Roger, Jr. (U. S. Navy), thr
holic specimen of reptiles, alcoholic specin
nota, alcoholic crab, and alcoholic specim
Hoplosternum littorale, 3 bats and a mouse,
tution. National Zoölogical Park).

Welsh, Mr. (See under Kingston Exposition

Wesley & Son. (See under Thomas Rogers.)

West, Gerald M. (Worcester, Mass.). Two I
obtained from the Miemæs of Nova Scotia

Westall, S. J. (Paint Gap, N. C.). Specimen
Toe Post Office, Yancey County, collect
National Museum. 24998.

Weston, Arthur H. (Georgiana, Fla.). Fra
County. 24709.

White, A. W. (Albert Lea, Minn.). Seven st
arrow and spear-heads, from the vicinity

White, Dr. C. A. (See under Interior Depar

Waite, Dr. C. H. (U. S. Navy, Navy Depa
Iquique, Chile; collection of miscellaneou
Payto, Peru. 24624.

White, E. H. (Astoria, Oregon). Land and

White, Harry G. (Department of Agricultur
and short-eared owl (*Asio accipitrinus*) i
25076.

Waite, Miss (Theological Seminary, near Ale

Whitton, William R. (Seattle, Wash.). Par
Elephas primigenius. 25161.

Wilbur, Miss Charlotte D. (Newark, N. J.).
Harrison, clerk of the North West Territo
1800, indorsed by John Cleves Symmes.

Wilbur, Mrs. Matthias Denman (Newark, N
John Adams, President of the United Stat
granting 4,000 acres in the North West Te
25551.

Wieland, George R. (State College, Pa.).
(Gift, exchange.) (24831, 25106.)

Wilcox, Dr. Timothy E., U. S. Army (Fort
and valuable collection of reptiles, consis
species, including *Crotalus molossus*, *Elap*
and others, insects, mammals, specimens
chub (*Squalius*); alcholic specimens of
(25653).

Wilcox, Walter D. (New Haven, Conn.). Se
fossils representing 17 species from Mt. St
Acrotreta gemma, var., *depressa* Walcott, *A*
subsidua; *Hyolithes* sp. undet.; *Hyolithell*
sp. undet.; *Kutoigina* like *stissingensis*; *L*
sponge, *Scenella* sp. undet.; *Ogygopsis klo*
paria cordilleræ, *Bathyuriscus howelli*; *Olen*
25155.

Wilder, Prof. B. G. (See under Cornell Uni

Wildman, Hon. Rounsevelle (U. S. Cons

Wildman, Hon. Rounsevelle—Continued.
Malay musical instruments, kris, war-shield and game of chance (24951);[*] collection of shells, Dyak and Malay ethnological objects, musical instruments, and corals (25862).[*]

Wilkinson, E. (Mansfield, Ohio). Specimens of *Branchiopus*. 25435.

Willcox, Joseph (Philadelphia, Pa.). Minerals (24802); tertiary fossils from North Carolina and Florida (25472). (See under Wagner Free Institute of Science, Philadelphia.)

Williams, Dr. George H. (Johns Hopkins University, Baltimore, Md.). Contorted rock from Sugar Loaf Mountain (25057); minerals consisting of anglesite, cerussite, graphite, carrollite, tremolite after pyroxene, celestite, kämmererite, baltimorite, barite, dolomite, chrome tourmaline, pucherite, and amphibole showing sliding planes (25450). Exchange.

Williams, J. H. (Charleston, S. C.), through R. L. Garner. Fragments of leg-bone and vertebra (reptilian) from the phosphate beds of Charleston, S. C. 25125.

Williams, R. S. (Great Falls, Mont.). Nest and 4 eggs of *Geothlypis macgillivrayi*, and nest and 3 eggs of *Empidonax flaviventris*, representing rare and desirable species (24630); through Capt. Charles E. Bendire, U. S. A., 2 skins of western flycatcher (*Empidonax difficilis*) (24832).

Williamsburgh Scientific Society (Brooklyn, N. Y.). Fossil rock found in the Catskill Mountains (25500); through Mr. Louis Kirsch, fossil rock from High Falls, Greene County, in the Catskill Mountains, 2 specimens of beryl and 7 of garnet from the mica mines, New Milford, Connecticut (25719).

Williamson, H. W. (New Galilee, Pa.). Twenty-nine stone implements from Pennsylvania, Maryland, Illinois, Kentucky, Tennessee and New Mexico. 24838.

Willige, J. Louis (U. S. National Museum). Ancient German accordion brought from Germany by Mrs. Mary Mertag about 1850. 25584.

Willis, Bailey. (See under Interior Department. U. S. Geological Survey.)

Willis, E. (Charleston, S. C.). Collection of soft, hard, and pebble Florida phosphates. 24640.

Wilson, N. L. (Boston, Mass.). Specimen of tremolite on dolomite from Lee, Massachusetts; sphalerite with implanted marcasite crystals from Webb City, Mo. Exchange. 25738.

Wilson, Scott B. (Heatherbank, Weybridge, Surrey, England). Skin of *Loxioides bailloui* from Hawaii (gift) (25142); alcoholic specimens of *Hæmatione sanguinea, Loxioides bailloui, Phæornis obscura, Hemignathus procerus, Oreomyza bairdi* (purchase) (25638); alcoholic specimens of *Hæmatione sanguinea, Hemignathus procerus and Oreomyza bairdi* (gift) (25639).

Wilson, Thomas (U. S. National Museum). Seven rude implements from Burlington, New Jersey, 16 rude implements from Morris Island, and 151 specimens, comprising implements, cores, flakes, and other objects of argillite, from near Point Pleasant, Bucks County, Pennsylvania (24891); 9 leaf-shaped implements, 2 worked flakes, 31 arrow-heads, 3 polished hatchets, pendant or sinker, and 2 drilled tablets (surface finds) from near the "Hopewell Enclosure and Tumuli," Ross County, Ohio (25461). Deposit. (See under Dr. N. L. Britton.)

Wilson Mining Company (Brunswick, Me.). Feldspar and quartz from the quarry of the company at Topsham. 25585.

Winston, B. C. (Monterey, Cal.), through Alaska Commercial Company. Mounted porpoise (*Delphinus* sp.), from Carmel Bay. 25729.

Witman Brothers (Reading, Pa.). Sandstone from the Pennsylvania quarries. 25443.

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[*] Purchased for the National Museum at the request of the Secretary of the Smithsonian Institution.

Wolf, Dr. **Joseph** P. (Elkton, Va.). Exostosed tooth of horse, *Equus caballus.* 25612.

Wolfe, M. (Dayton, Ohio). Half-tone negative, etched relief-block, and impression from the block, reproducing a scale of tints from black to white (25176); an 8 x 10 sealed screen, 124 lines to the inch (25274). Purchase.

Wolhaupter, Dr. D. P. (See under Maj. W. H. Powell.)

Wood, Miss E. M. (Liscard, Cheshire, England). Seven colored figures of jelly-fishes and other invertebrates (25182); 10 colored figures of invertebrates (25816). Purchase.

Wood, Tingley S. (Leadville, Colo.). Two specimens of cerussite from Silver Cord Mine, collected by Prof. S. L. Penfield, of the U. S. Geological Survey. 24810.

Woodhull, Miss M. (Washington, D. C.). Spinning wheels, reel, butter-bowl, wooden paddle, and pewter platter. 25766.

Woodruff, Dr. **Charles** E., U. S. Army (Fort Missoula, Mont.) Stone baking-dish obtained from the Hupa Indians of California (gift) (25043); through Mr. Garrick Mallery, of the Bureau of Ethnology, a collection of photographs relating to the same tribe (deposit) (25158).

Woods, Frank T. (Charcas, Mexico) through P. L. Jouy. Ores from Santa Ynez Mine. 25212.

Woodward, Dr. **Henry** (see under British Museum, London, England).

Woolman, A. J. (see under J. T. Scoville).

Wooster, A. F. (Norfolk, Conn.). Coin from Hayti (24529); bat (*Adelonycteris fuscus*) (24911); copper coin from France, dix centimes of 1864 (25485).

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